The Builder.

VOL. LXXXV.—No. 3159. AUGUST 22, 1903.

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Manchester and Salford Skin Hospital ..... Messrs. T. Worthington & Son, Architects.
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Apulia.

THE south-eastern region of Italy, where the energetic Prime Minister, Signor Lanardelli, has recently been investigating the miserable condition of affairs (in some cases exploring the district in a bullock-cart), seems cut off from the rest of the peninsula in a curious manner by differences in race, manners and customs, and to some extent in the matter of language. In art the province of Apulia has always been widely distinguished from the more favoured north and west of Italy, and chiefly by the absence of that remarkable sense of the finer æsthetic character which seems a part of the Tuscan nature.

The mountain ranges which extend southwards of Rome divide the Neapolitans proper of the Mediterranean shore, with their imported tastes for the arts and luxuries of life, from their more indolent and squalid neighbours on the Adriatic. Naples and its adjacent district probably owes all that it possesses of an artistic character to the influence of Rome and the powerful foreign races which have successively tyrannised over the mixed population of the largest city of the Mediterranean. But the luxury of the capital has scarcely penetrated into the outlying districts of Apulia, the Basilicata, or Calabria. In Classic times Apulia formed part of the vast area known as Magna Grecia, and at the present day a very remarkable similarity still survives in many respects between the far south of Italy, Greece and the Archipelago, and Cyprus. For centuries this extensive area of the Eastern Mediterranean has been occupied by a race which is popularly described as "Greek," but which has in reality very little claim to be descended from the ancient Hellenes. The language of the ancients survives in the modern "Romaic," owing to the singular conservative nature of Levantine Christianity, but beyond that tie with a remote past very little else remains from classic times. Under the *ægis* of a common religion opposed to Mohammedanism on the one hand and the vigorous Christianity of the West on the other, the strange mixture of Albanians, Sclavonians, Anatolians, and Eastern Neapolitans seems to have adopted a common language and a common form of art during the Dark and Middle Ages.

To a student of the history of architecture the chiefly interesting feature of this district is the presence of a distinctly "Gothic" or pointed arch style which prevailed during the thirteenth and fourteenth centuries—the period of the contemporary "Gothic" of Western Europe—and may be said still to survive in certain places.

Architecture in Apulia of the centuries immediately preceding the thirteenth can hardly be studied in any surviving examples with the exception of those of a purely ecclesiastical sort. Few, if any, domestic or civic edifices remain of an early period north of the Alps—and even in Italy they are extremely rare. During the long artistic interregnum between the ancient world of classic times and the revival of the arts and sciences in the early Middle Ages, a singular disregard for the domestic arts and luxuries of life seems to have prevailed. Such few traces as we possess of the architecture of the dark ages are usually in the form of church buildings, with little pretension to design, bedizened with very meretricious and often meaningless ornament. The contemporary feudal castles have little about them to suggest an architectural style. In Apulia the Romanesque castles and churches resemble those of other countries, and the latter are only remarkable for their large numbers.

With the advent of the thirteenth century the invigorating influence of the pointed arch style made itself felt all over the civilised world, and Apulia was not behind the rest of Europe in displaying a particular development of the fashionable art. This particular development may, perhaps, be classified as a section of the pointed-arch or "Gothic" style common to Magna Grecia and the Levant.

The Gothic art of Cyprus is being exhaustively described and illustrated in a magnificent French publication, the third volume of which is still in the press.* The remarkable development of "Gothic" under the Lusignan kings in this eastern island may perhaps be attributed to influences which erected Cyprus into a species of bulwark against the Mohammedan encroachment of the period, and induced the Cypriots, for obvious reasons, to adopt a style so specially characteristic of western civilisation. In the Morea and the ancient Dukedom of Athens the once-flourishing principalities founded by northern adventurers are in a similar manner still recorded by innumerable "Gothic" monuments, and the influence of the style may be detected even in modern days. But in Apulia the style is still more at home, although its palmiest days were doubtless at a time when the harbours of Brindisi, Bari, or Taranto were crowded with shipping and transports for the crusading armies of Europe.

The local variations in the great all-pervading pointed arch style of mediæval Europe depended chiefly on climate, and still more on the building materials at hand. In Apulia—as all over the South of Italy—architecture has been very much handicapped by the wretched character of the local stone and the absence of brickwork. *Tufa* is almost the only building stone procurable, and, although good enough for mere walling, is, from its rough and uneven texture, unsuitable for any artistic expression in carving or moulding. Not until the days of Michelangelo and the pseudo-Classic school did such materials play any part in architectural designs as "rustications" or other more or less meretricious aids to a ponderous magnificence. The Southern Italians of the middle ages built their houses, castles, and churches in the prevailing "Gothic" style, but always with the intention of covering up the masonry with gypsum and limewhite both inside and out. The climate admits of such a system, and the local materials oblige it; for decorations they relied upon imported marble or stone, and still more upon the inevitable brush-work of the mural painter.

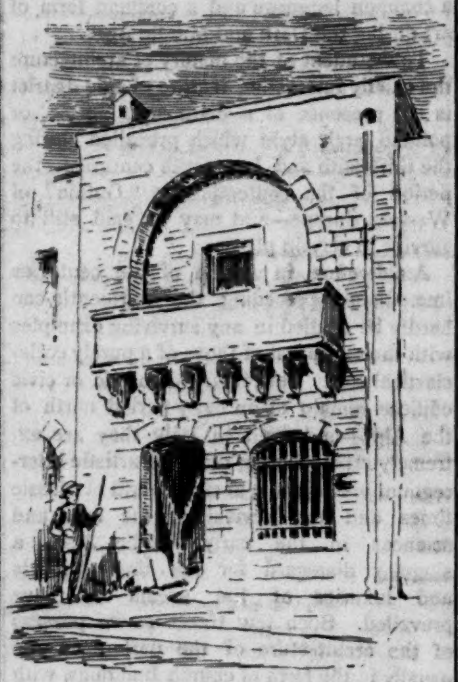
The style of the Gothic buildings of Apulia—ecclesiastical and secular—clearly belongs to the Tuscan school of Italian art. This is remarkable considering the immense influence of Venice, not only on the opposite coast of the Adriatic, but in the comparatively far-distant Morea, Crete, and Cyprus. To pass over from the Dalmatian coast of the Adriatic, with its quaint old Venetian cities of Sebenico, Spalatro, Ragusa, &c., to the opposite side (in places visible with the naked eye from one side to the other) affords

* "L'Architecture du Moyen Age au Chypre." Par M. Enlart.

a remarkable contrast in every characteristic. The narrow *cullè*, the ogee-headed windows opening on to little marble balconies, which meet the eye at every point in the crowded intricacies of a Venetian town; the slender campanili, crowned with the short conical spire of the lagunes, are nowhere to be seen in Apulia. On the contrary, the wide straggling streets of an Apulian town lined by low flat-roofed houses, with little or no architectural pretensions; the comparatively low church towers, built in stories of width diminishing with their height; the all-pervading presence of whitewashed plaster, impress the architectural student with a truly Levantine aspect. At the same time, the tall narrow churches with wooden roofs and deeply splayed windows, the wide segmental arches over doorways and in cloistered arcade, are distinctively Tuscan, and more reminiscent of S. Croce, Florence, than anything to be found in Venice. This striking contrast between the two sides of the Adriatic may be attributed partly to the greater frequency of earthquakes in South Italy, necessitating a one, or, at most, two-storied mode of building; but the presence of the Tuscan details of architecture can only be due to the immigration of northern masons, possibly accompanying such materials as were imported for decorative purposes. The spread of the Franciscan Order, which seems to have so greatly influenced the growth of the Gothic style during the thirteenth century in other parts of Italy, must also have had a share in introducing the northern character. As has been shown in a previous article in the *Builder* on Franciscan Architecture (September 27, 1902), the evolution of the "Gothic" style is intimately associated with the foundation of the great Orders of Friars, and in Naples itself one of the largest of Friars' churches ever built (Santa Chiara) is still *en évidence*. This immense edifice was unfortunately too much transformed during the sixteenth century with plaster and painted decorations to allow of its mediæval character to survive or its vast proportions to be appreciated at the present time.

The "Gothic" churches of Apulia are but little known, and the subject invites an extensive monograph such as M. Enlart has so ably carried out for the cognate architecture of Cyprus. At the same time, some of M. Enlart's arguments for a purely French origin of the Cyprus style would, perhaps, receive modifications if the mediæval art of the far south of Italy had received that attention which it certainly merits. For instance, the church of S. Domenico, Taranto, a building of the usual Tuscan plan, with short aisleless-nave side chapels and wooden roofs, has an interesting façade, the great doorway of which is almost identical in detail with the west front of the cathedral of Famagusta, Cyprus. The same richly moulded arch is covered by the same elaborately carved dripstone ornamented with large acanthus leaves. The way in which the plinths and mouldings are twisted into steps and rectangular panellings also betrays a kindred masoncraft. The Taranto example only differs from the Cyprus churches in having a somewhat older and more decayed appearance. Another example of the Tuscan plan and method of construction carried out with the proportions and details characteristic of Cyprus is the Abbey of S. Maria della Guistizia, a twelfth-century building situated a short distance to the west of Taranto. The Church of S. Paolo, Brindisi, exhibits a similar combination of Eastern and Western "Gothic;" the tall lancet windows of the Tuscan wood-roofed church have traceries and mouldings suggestive of Cyprus, and its internal proportions would harmonise with such details if it were ceiled with the Cypriote stone vaulting.

The domestic building of Apulia is much more distinctly classified as Levantine than the churches. The flat-roofed houses are usually, in part, constructed with the domical vault of the East in which the arris, or "Suk," as it is called in Syria, of the vaulting, rises much higher than the line of curvature against the walls—and forms, in fact, a species of four-sided dome. In the older buildings this method of construction seems to have been adopted for both stories of the ordinarily low built houses. Comparatively small vaulted rooms are a natural result of such construction, and the most characteristic feature of Apulian towns is the small mediæval house, the lower story used as a



Characteristic Street House of an Apulian Town.

shop or entrance, the upper vaulted room towards the street having a front wall formed of a wide arched recess, which forms also a partial cover to a balcony carried on moulded corbels.

Palaces or imposing buildings are comparatively rare in Apulian towns, the mediæval art of the northern cities fostered by aristocratic families or civic institutions is nowhere represented. On the contrary, the towns are made up of small traders' houses clustering under the shadow of an inevitable castle, the representative stronghold of a more or less alien government.

Castles are, indeed, the very commonest features of the Apulian landscapes. Hardly an horizon comes into view on which some ruined fortalice does not appear to remind the modern traveller of a romantic past, when this country would seem to have been the very centre of warlike enterprise, and the much fortified frontier between East and West. The splendid triangular fortress of Oria, the home of the famous Doria family, is one of the most beautiful of mediæval castles, as it stands proudly predominating the watershed between the Adriatic and the Gulf of Taranto. The castles built by Emperor Frederick II. have a special interest, and several of them are particularly well preserved, and of a later date those remodelled by the Emperor Charles V. are of the greatest importance in the history of military architecture.

LEAD-POISONING AND WATER SUPPLY.

ONE of the most valuable inquiries the Local Government Board has ever undertaken is that relating to lead-poisoning induced by the quality of the water supplied to some of the large cities and towns in Lancashire and Yorkshire, a full Report* on which is now before us. The book is the result of most careful investigation in the field and laboratory, and the work has proved very fruitful in new discoveries, though much old matter is, of necessity, incorporated. The inquiry was more particularly directed to moorland waters. Some years ago it was discovered, when dealing with the water-supply to Sheffield, that the problem of the relationship between the conditions of a gathering ground and the lead dissolving property of its water called for consideration of a number of biological, as well as of chemical, questions, and this Report deals with both those aspects of the matter. The results of laboratory experiments made to determine the varying conditions under which a water may retain or lose its ability to dissolve lead, will be published in a separate volume; and we are promised that that volume will also contain records of experiments with bacteria derived from peat, lead erosion, &c.

The investigators have confirmed the view that it is the power to dissolve the lead of water pipes, whether new or old, which renders a moorland water a potential source of danger to the consumer, and the present volume deals almost wholly with plumbo-solvency. The first part contains records of sustained observations, made at the moorland gathering area selected at Burnmoor, forming part of the Bentham waterworks; and the second part records the results obtained when the experience of Burnmoor was applied to the moorland gathering grounds of twenty-three waterworks in Lancashire and Yorkshire, most of which are large sources of supply under the control of public authorities.

The records published in the first part of the book establish on a broad basis of observation that the factor essential to the possession by a water of plumbo-solvent properties, is acidity, and that the degree of acidity and of corresponding plumbo-solvent ability is determined by the presence of peat on the gathering area, and by the conditions under which the drainage of the peat gains access to the supply. But the ratio between the degree of acidity and the degree of plumbo-solvent ability is not necessarily the same for all peaty waters. Other observations at Burnmoor show that certain spring waters may habitually possess power to neutralise the acid of peaty water, and when two springs come together the mixed waters may under such circumstances remain without action upon lead.

* "Supplement to the Thirtieth Annual Report of the Local Government Board, in continuation of the Report of the Medical Officer for 1900-01." London: Eyre & Spottiswoode. 1903.

That section treating of the "Differential examination at weekly intervals and over a prolonged period, of waters of diverse sort from one and the same moorland gathering ground," is, on the whole, perhaps, the most valuable part of the book. It deals specially with the results of submitting severally to frequent comparative tests waters which, when combined together at a distance from their common moorland gathering ground, constitute a public water supply. We have already alluded, in broad outline, to some of the results obtained. One of the important problems intended to be solved by this mode of investigation was as to how far diversity of the ability of moorland waters to dissolve lead is associated with season of the year, and is at the same time parallel to observed differences in their chemical and bacterial characters. Burnmoor, near Settle, was selected for the experiments chiefly because the West Riding of Yorkshire had for long been associated with a special incidence of lead poisoning, due to moorland water-supply. The water from Burnmoor was credited with the possession from time to time of an extreme degree of acidity, and it was also believed to act, on occasion, vigorously on lead. These experiments, however, prove that the sum of the various waters which mixed together from the general supply to Bentham, showed little or no evidence of possessing such injurious properties, although certain of the contributory waters were conspicuously acid, and possessed plumbo-solvent ability in a very marked manner.

The Report describes the method of investigation on the ground at some length, but we will not enter into that. A small meteorological station was erected on the gathering area, and a laboratory established at Settle. The nature of the chemical experiments carried out is also explained, and several tables recording the results of the chemical examinations are appended. Some of the columns are very significant. One column, for instance, relating to the colour of the waters as collected for examination states "pale straw," "pale green," "grey," "blue," and so on, so that in regard to the majority of the samples a strong suspicion must have attached to them even before they were submitted to chemical investigation. Another column deals with turbidity, and we see such records as "hazy," "distinct," and "great" occurring. The residue, when present, appears to be chiefly moss.

Weekly records of the rainfall, flow of streams, and the temperature of the soil were taken on the gathering ground, but they do not seem to have been of much use in the inquiry, and it is observed that "weekly meteorological records confined to one spot were hardly sufficient." In regard to the influence of the season of the year, the Burnmoor experiments indicate that acidity and plumbo-solvency are apt to be at their maximum in the late summer and autumn, but the question of season is, necessarily, complicated by the rainfall, inasmuch as the manner of distribution of the rain over the gathering ground in any particular year is hardly likely to be exactly repeated in any subsequent year. Moorland waters alone, which are commonly a mixture of surface peaty water and spring water, are not, however, unfrequently neutral during the summer months, and acid during autumn, winter, and spring. This is believed to result from the circumstance that during summer the neutral spring water relative to the acid surface water is usually at its maximum, and that during the rest of the year these conditions are commonly reversed. The most acid condition of moorland waters, it is remarked, has been encountered during a storm following a period of drought, and when the first "washings" of the peat were being carried into the supply, which is what one might have anticipated.

Practically all the experiments detailed in the first section of the book were carried out by Dr. Houston, and a further series were subsequently made at Bentham reservoir. The principal objects of these latter were to examine the water in the reservoir itself. In addition to minute chemical investigations, the water in the reservoir and the inflow water were subjected to bacteriological tests, as also were peat pool water and peat soil. The additional chemical experiments do not seem to have added much to the experience previously gained, but during the whole period of observation, which extended over some months, the water in the reservoir was proved to have no solvent action upon lead.

With regard to the bacteriological experiments during the prosecution of the work, much was learnt. Some tables are given showing results, but the summary is the most interesting part of this section of the book. The net result has been to afford "presumptive evidence of the strongest kind that the antecedent cause of the acidity and plumbo-solvent ability of a moorland water is the vital action of particular species of bacteria in moist peat soil." That conclusion is not only very useful from a water-supply point of view, but is of considerable philosophical interest also. This part concludes with a number of plates of diagrams illustrating various experiments carried out during the progress of the work.

The second part of the book, dealing with the results of surveys of moorland gathering grounds in Lancashire and Yorkshire, is also an important contribution to our knowledge of certain water-supply problems. The waterworks of which surveys were made are as follows:—

1. Ashton-under-Lyne, Stalybridge, and Dukinfield (District).
2. Bacup Corporation.
3. Barnsley Corporation.
4. Barrow-in-Furness Corporation.
5. Batley Corporation.
6. Blackburn Corporation.
7. Bolton Corporation.
8. Bradford Corporation.
9. Burnley Corporation.
10. Colne (Lancs) Waterworks.
11. Dewsbury and Heckmondwike Water Board.
12. Halifax Corporation.
13. Huddersfield Corporation.
14. Keighley Corporation.
15. Leeds Corporation.
16. Morley Corporation.
17. Nelson Corporation.
18. Oldham Corporation.
19. Preston Corporation.
20. Rochdale Corporation.
21. Sheffield Corporation.
22. Shipley (Eldwick) Waterworks.
23. Wakefield Corporation.

The results are classified in regard to each survey as follows:—General information is first given on the source of the water supply and a description of the waterworks, which is followed by: (*a*) On the character of the gathering ground, (*b*) on conditions found to exist on the gathering ground at the time of the inspection, and (*c*) on the results yielded by the chemical examination of the waters in reference to the observed characters of the gathering ground.

Each survey Report is accompanied by a map, which materially assists the reader in studying the various problems raised. In these maps the uniform plan is adopted of colouring the streams, reservoirs, &c., red or blue, according to whether the chemical reaction ascertained was acid or neutral. The distribution of peat is shown by a brown tint.

Particulars are given as to the methods adopted to determine the plumbo-solvency of the various waters collected, as well as the proof of acidity, reaction, and hardness. In some of the experiments peat was removed from various gathering grounds and placed in the laboratory under conditions resembling as closely as possible those on the moors as regards the relation of the peat to the rainfall. Thus, artificial peat pools were constructed, and neutral water was filtered through peat both continuously and intermittently. Dr. Houston remarks that the results were all alike in one respect, and showed that a small amount of peat can render acid a relatively large bulk of neutral water. We cannot, however, allude to all the methods adopted, nor are we able to describe the results of the visits to the various waterworks.

Amongst the conclusions arrived at, other than those already given, are that moorland gathering grounds are usually rich in peat, and that the history of epidemics of lead poisoning due to water supply—at all events in the North of England—clearly shows that the towns which have suffered in the past derived their water supply from moorland sources. The "conclusions," however, are so numerous that the book must be consulted thoroughly to appreciate them.

The surveys of the waterworks mentioned were chiefly made some time since, as the investigation has taken some years to carry out. Some of the results have been published before, and in at least one case, that relating to the water supply to Bolton, the Local Government Board felt it their duty to call the attention of the Corporation to the state of affairs which existed, as a result of the knowledge obtained from Dr. Houston's inquiry. Extra precautions were, of course, immediately taken by the Corporation. Extra precautions have also been adopted by the authorities of other waterworks since that official's visit.

The Medical Officer, in his summary of the whole Report, gives some advice as to how far it is possible to prevent moorland water from dissolving lead, though we do not see much that is new in his observations. The question that should first be asked, he remarks, is whether specially acid water can be altogether excluded from the supply—for example, by eliminating the drainage of special peaty areas, or by providing "leaping weirs," contrivances which ensure that the first washings from the peat, after a period of drought, are automatically rejected. In the case of a water supply habitually acid, Dr. Houston says that the neutralisation may, perhaps, be most satisfactorily effected by ordinary sand filtration, with the addition of some neutralising material (such as a thin coating of lime on the

surface of the sand, with limestone underneath the sand) to the filter, and the subsequent addition of a trace of sodium carbonate to the neutral filtered water. Frequent examinations to test the effects of this or any other treatment of the water should be made.

With all this we cordially agree; it is, however, one of the most difficult problems the water engineer has before him altogether to eliminate fragments of peat, and it is doubtful whether ordinary sand filtration is sufficient for the purpose. The acid water would be neutralised, and some of the peat would, of course, be removed in filtering, but the water may still remain slightly discoloured. We are not unmindful, though, that the chief object of this Government inquiry was to deal with what connexion there may be between water supplies and lead poisoning, and the book does not treat exhaustively on various methods of filtration and their effects. This object has been attained by most painstaking investigation spread over many years, and the Medical Officer and Dr. Houston are to be warmly congratulated on the remarkable results of their labours, which cannot fail to be of the greatest service to all those who have to deal practically with moorland water supplies.

NOTES.

The British Association.

It is now possible to give a few particulars concerning the forthcoming British Association meeting to be held at Southport, commencing September 9. The President, Sir Norman Lockyer, is expected in his opening address to prove by statistics, which he has been for some time engaged in collecting, that our industries and national life generally are suffering very seriously from the neglect of science in education. Of course, we do not know the details he proposes to give to substantiate his point, but we can all admit the truth of the general statement so far as higher education in some of its branches (especially technical) is concerned. He is to say that our modern universities are not properly equipped, that we have depended too much on private enterprise, the result being that we are behind both the United States and Germany. The President thinks that a very large expenditure, which should be borne by the State, and which he is said to place at 20,000,000*l.*, is necessary before we can hope to be efficient or to be able to compete successfully with the countries named in the highest aspects of scientific education. He will also say that the State should endow research. We will not comment on these schemes now, as we have not the full text of the address before us, but the President is evidently going to make out a strong case for the teaching of the practical aspects of science in universities. From what we can learn, the Southport meeting should be a success.

The Workmen's Compensation Acts.

The House of Lords have given a decision in the case of Fenton *v.* J. Thorley & Co., Ltd., of much importance to all employers of labour, under the Workmen's Compensation Act. A man whilst unscrewing a press used in making oil cake ruptured himself owing to his having to exert some extra effort on account of the press sticking a little. The Court of Appeal, following a decision of that Court in 1900 (Hensey *v.* White), when the facts were very similar, decided against the man's claim, on the ground that this was not injury by accident. The House of Lords has now reversed this decision, holding that the man was entitled to compensation. The cases on this important question have hitherto been decided in such a manner that great uncertainty in the law has existed; thus in Boardman *v.* Scott, where a man in his ordinary duty was removing a beam from a loom and strained himself whilst hitching it on to his shoulder, the Court of Appeal held him entitled to compensation under the Act, whilst in Roper *v.* Greenwood, where a woman most seriously injured herself whilst lifting boxes rather heavier than those she was in the habit of lifting, the plaintiff was held to be disentitled to compensation, the distinction drawn between the two cases being that in the latter case the woman had complained beforehand that the boxes were too heavy, from which the Court drew the deduction that there was no "accident," since there was nothing fortuitous or unexpected in what had occurred. This case is now also overruled and all such subtle distinctions have been swept away. The House of Lords have defined an "accident" to be an untoward event or unlooked-for mishap not expected or designed, and further have held that the mere fact of a workman suffering injury out of and in the course of his employment primâ facie entitles him to compensation, and that the onus is thus laid upon his employer to exempt himself from liability by showing that the injury was sustained by reason of some other cause—for instance, ill health. With the question of whether only the immediate cause is to be regarded, or whether rather the efficient cause might not be considered under the Act, we dealt in our issue for June 28, 1902, and the House of Lords have now decided the matter in accordance with the view we then expressed; the efficient cause, or *causa causus*, is to be sought in determining the origin of the accident or injury.

By-laws and Magisterial Discretion.

The Law Reports contain this month an important decision, in the case of Salt *v.* Scott Hall on the discretion vested in justices in enforcing the by-laws of Rural District Councils. The appellant had built a bungalow, which was not erected in compliance with a by-law which prohibited the erection of any new building without walls of brick, stone, or other hard and incombustible materials, mortared or cemented together. The foundations were stone, the chimney and breastings brick, the roof slate and the rest of the building wood. The bungalow was an isolated building 200 yards from any house. The by-law was properly made and confirmed by the Local Government Board in accordance with the Public Health Acts. It was contended, however, that it was void since it gave no discretionary powers to the justices, and the justices adopted this view. The Divisional Court have held that the by-law was valid, but that Section 16 of the Summary Jurisdiction Act, 1879, under which proceedings were taken, gave the justices a discretion, and they had the power either to inflict a nominal penalty or even to dismiss the summons altogether. This decision seems exactly to meet the Eynsford case of Mr. Till's cottage which was so much discussed last year both in these columns and in the Press generally, and we cannot but think that in that case the justices cannot have been aware that they possessed any such discretion. The wooden huts, or rather hutches, in which the fruit pickers of Kent are temporarily housed during several months of the year, are a scandal to civilisation, and, if we remember rightly, it was Mr. Till's wish to provide more suitable accommodation and to erect good wooden cottages. How it is that the present miserable huts continue to be used in these days of strict sanitary and building supervision, we do not attempt to explain, but this subject is one which urgently calls for thorough investigation.

Nottingham Castle.

The Castle Museum Committee of the Corporation of Nottingham have resolved to ask for a loan of 10,000*l.* for carrying out a restoration of the Castle lodge (which has been in a serious state of dilapidation during several years past), the repair of the boundary-walls, the building of a new estate office for the Duke of Newcastle's agent, the laying out of the gardens to the south-east, and other works. In the *Builder* of May 23 last we illustrated Mr. T. G. Jackson's designs for an adaptation of the gateway to purposes of the Museum, together with a view of the gateway in its present condition. The gateway consists in part of a mere shell, the other part being the estate office. The Castle, on the Castle Hill, was built by William Cavendish, first Duke of Newcastle, in 1670-6, after the Classic style; having been afterwards sub-divided into separate tenements it was sacked and burned in 1831 by a band of Reform Bill rioters. The structure continued in a state of ruin until its restoration by the Corporation, who hold the castle and grounds from the Duke of Newcastle, as a Museum of Decorative, Industrial, and Pictorial Art, at a cost of 30,000*l.* The various collections comprise some 500 designs and drawings by T. Stothard, R.A., and a fine collection of Wedgwood ware—both given by the late Mr. Felix Joseph; some paintings, including views of Edinburgh, Frankfort, Nuremberg, and Rome, by G. Jones, R.A., and bequeathed by his widow; and Lord Savile's collection of classical antiquities. The gateway and some earthworks constitute remains of the fortress originally erected by William I. on the site of a more ancient stronghold that stood on the summit of a bold eminence rising above the river Lene, a tributary of the Trent. The castle was strengthened and enlarged in the reigns of Edward IV. and Richard III., and dismantled during the Commonwealth. The Duke of Newcastle, having bought the property from the Duke of Buckingham, pulled down the ruins for the re-building we have mentioned.

Hydraulic Dredging with Rotary Cutters.

In a paper recently read before the Institution of Civil Engineers, Mr. Apjohn described his experience in excavating clay by means of hydraulic dredgers having rotary cutters fitted to the nozzles of the suction pipes. As the material was of silty character, it was believed that it would be readily broken up by the cutters, but this was

not found to be the case. In the loamy soil first encountered the cutters answered well, but on arriving at the clay the blades became clogged, and the amount of clay in the water discharged was very small. After some experiments a new form of cutter was made with narrow spiral knives, but this device was not particularly successful. From the experience detailed in the paper we learn that, while the efficiency of the cutter depends upon the form of the blades, the angle at which they are set, and on their spacing, it is difficult to determine the best form for adoption without the aid of exhaustive experiments, such as have not been conducted up to the present time.

Tasmanian Hardwood Timbers.

THE Tasmanian Government is doing its best to bring the qualities of the timbers of Tasmania to the notice of users of hard wood in Great Britain. A year since an official Report on them was issued, and now the Agent-General sends us a supplementary pamphlet giving the opinions of several Tasmanian officials who have had to deal with the hard woods of the country for many years. The Engineer-in-Chief of the Department of Public Works says that native-grown "blue gum" and "stringy bark" have been used for general constructive works from the earliest times, and with satisfactory results. Railway sleepers of these woods last on the average about fifteen years, though the life of the wood is, of course, dependent in a great measure on the rainfall, which varies very considerably in different parts of the country. Other reports follow much in the same strain. All those who make the reports agree that the two varieties of hard woods mentioned are amongst the best in Tasmania; and some are of opinion that the "blue gum" has a longer life than "stingy bark." Both the woods have stood well as piles in tidal waters, for bridges and the like, and some of the piles are a hundred feet in length. Judging from the experience of Tasmanian engineers and surveyors, these timbers are well worthy of the consideration of users of hardwood in this country.

Raising Water by Compressed Air.

IN a paper read at the annual meeting of the British Association of Waterworks Engineers, Mr. W. H. Maxwell described the air-lift pumping plant that was installed at Tunbridge Wells about three years ago. This plant has been raising water from depths varying between 98 ft. and 118 ft., and appears to have given every satisfaction. Few systems have come more rapidly into general use than that in which compressed air is employed for raising water; and it is, perhaps, a natural consequence that theory is somewhat behind practice. The simplicity of the apparatus required, and of the laws by which its operation is governed, seems to suggest no theoretical difficulty; but the fact remains that the more the system is examined the more elusive are the solutions of the problems presented. Experimental data are badly wanted upon various points before it will be possible for schemes to be prepared in such a manner that economical and otherwise satisfactory results may be reasonably assured. Although economy of operation does not appear to be one of the primary recommendations of the air-lift, there are various circumstances under which its application may be more than justified. For temporary use in well-testing or boring, and for permanent use in cases where water is derived from sandy beds, the absence of valves in contact with the water is a distinctly advantageous feature. The fact that 80 per cent. more water can be raised by this than by any other system, from a boring of given diameter, is another great advantage, and so is the fact that an air-lift plant of moderate capacity can be installed far more expeditiously than ordinary pumps. The system is certainly of great interest, and deserves the most careful investigation from engineers and others interested in water supplies.

The Panama Canal.

A NEW difficulty has arisen in the way of the Isthmian Canal scheme, owing to the rejection of the Treaty by the Senate of the Colombian Parliament. Advocates of the Panama route have had to contend with opposition from politicians who believed the Nicaraguan Canal preferable from a patriotic point of view, and from politicians who merely represented trading interests. They also had to combat the view that the last-named route was the more practicable, and finally it was a tedious operation to persuade the Panama Co. to enter into an agreement for the sale of their property at a reasonable price. The present hitch may probably be regarded as nothing more than an episode, for it is unlikely that a work of such importance to the world can be definitely prohibited by a small American Republic. If the decision now arrived at by the Senate should be confirmed by the Lower House of the Colombian Parliament, it is not unlikely that the United States may discover a remedy for such action in some application of that most convenient theory commonly known as the Monroe Doctrine.

The Coal Commission.

FROM the first Report of the Royal Commission on Coal Supplies it appears that inquiry has so far been confined to the depths practically attainable in mining, to the minimum thickness of workable seams, and to waste in working. As the inquiry is not yet complete, the Commissioners make no recommendations as a result of the evidence already taken, but some preliminary conclusions are justified by the matter contained in the Report. It seems to be clear that beyond a depth of 3,000 ft. the increasing temperature of the earth may seriously increase the difficulties of mining, and it is doubtful whether so great a depth as 4,000 ft. will be generally attainable. At low levels the earth pressure may become a serious obstacle to work in certain localities, and it may sometimes prove to be the case that thick seams of coal cannot be worked owing to their great depth below the surface. Thin seams can only be worked with profit when near the surface or when associated with easily worked materials. Consequently, in estimating the national wealth, so far as coal is concerned, we should not take into account the total amount existing beneath the surface, but the quantity that is practically realisable. When the Commission was appointed we said that we did not see the use of it, as experts already knew what available coal there was in the country, so far as it was possible for any one to know. The first instalment of the Report of the Commission amply justifies our prognostication. The evidence which has been laid before the Commission has been given by some of the leading authorities on the subject in Great Britain, and will, so far as detail is concerned, be better capable of being digested when all the facts have been published, which will not be for some time to come. A great deal has been made of the large supplies of coal which are supposed to be hidden by newer strata, and for years these hidden seams have been flourished before us as though it was quite certain they existed. The cautious geologist, however, will not have much to do with many of them. The majority probably do exist, but we want more proof of their actual occurrence. If the work of the Commission were to be extended so as to enable them to put down several bore-holes at likely places, we could understand that much useful work could be accomplished. There is no probability of their being able to do that, and our coal supply will have to be much shorter than it is at present before Government would sanction the sinking of bore-holes at the public expense. The most useful part of the Commissioners' work, so far as it appears in this instalment, is the careful ascertaining of what coal there is in sight, how far it is available, and what is the maximum depth to which coal can be worked. Particulars such as these, however, should be in the hands of the authorities of the Home Office already, through the medium of the Inspectors of Mines.

The Royal Academy Schools.

THE removal of the age limit for students to the Royal Academy schools, which comes into force next January, must be of interest to a good many architectural students. The comparatively small attendance at the architectural school has not, of course, been entirely due to the limit of age which until now has been in force. The examination is not a light one. It is no easy matter to have to draw out accurately to scale any one of the five Orders from memory in two hours; and the standard for finished drawings is fairly high. The finished works, if passed, admit a student as a probationer, but if he then fails to pass a somewhat tedious examination, he has to do a fresh lot of finished drawings to become a probationer again. But, when admitted, the three or five years' course of study has great advantages. The visitors who give courses of individual instruction in design are architect members of the Academy, whose criticism cannot fail to be a lifelong benefit and pleasure to look back upon. The prizes offered are numerous, though, under the new regulations, no one over the age of twenty-eight may compete for them. The travelling studentships are the most valuable offered in the profession, though, owing to the limited number of students, the competition is not so keen as at the Institute, and perhaps, as a rule, the work is not of so high a quality for the same reason. We hope the numbers may be increased, for, although the Academy cannot claim to foster architecture, we think that the schools for advanced students offer greater advantages than any other.

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THE BRITISH ARCHÆOLOGICAL ASSOCIATION.

The sixtieth annual Congress of this Association commenced on Monday, August 10, at Sheffield, under the presidency of Mr. R. E. Leader, B.A. It is thirty years this month since the previous visit of the Association to this city—then town, now incorporated city—of Sheffield, and only very few of the members at that time present now survive, Mr. W. de Gray Birch, the hon. treasurer, being the only Associate present at both meetings.

At three o'clock the members and visitors met at the Town Hall, where they were welcomed by the Lord Mayor (chairman) and the members of the Local Committee. The President having acknowledged the cordial welcome of the Lord Mayor and Committee, a move was made to the parish church, where they were received by Archdeacon Eyre, who conducted them to the church burgesses room to view the original charter granted to the burgesses by Queen Mary. It is in a fine state of preservation, and attached to it is the Queen's seal. The church was briefly described by Mr. J. R. Wigfull, A.R.I.B.A., one of the local hon. Secs., who said there was but little of the ancient structure now remaining, the chief portion being some stones in the wall on the south side, the whole building having been practically pulled down and rebuilt. The church was originally built in the early part of the twelfth century, and probably by Walter de Lovetot, the founder of the Priory of Worksop. The stones alluded to as the only remains of this church, were discovered during the restorations of 1878 and 1880. The tower piers and the inner lining of the walls of the east end are all the remains left of the succeeding church, and they are of the date of the fifteenth century. Mr. Wigfull illustrated his remarks by a careful plan and several old engravings. The Shrewsbury monuments, in the chapel on the south side of the chancel, are the only features of archæological interest, and are very fine examples of their style, particularly the altar tomb with marble recumbent effigies of the fourth Earl of Shrewsbury and his two wives. This chapel was erected by George, the fourth Earl of Shrewsbury, probably, shortly after the death of his first wife Ann, a daughter of William Lord Hastings, about 1520. George, the fourth Earl, died July 26, 1538, and the inscription upon the tomb is incorrect, as the second wife is buried at Erith in Kent. Against the south wall is the monument of the sixth Earl, who was the custodian of Mary Queen of Scots, and the inscription upon it is from the pen of Fox the martyrologist. The Earl died in 1590. The monument in the centre of the chapel bears the arms of George, the sixth Earl, and his first wife Gertrude Manners, and the sides bear the arms of their four sons. The late Mr. Samuel Mitchell, who had seen the accounts, said this monument was "the work of Rosigmond the Burgundian, in the year 1584-5, and that he was paid 20*l.* for it by George, sixth Earl of Salop." The church registers date from 1560. Leaving the church the party proceeded in carriages to inspect the remains of Manor Lodge, under the guidance of Mr. T. Winder, the Suveyor to the Duke of Norfolk's Yorkshire and Derbyshire estates, who had had reopened the excavation made thirty years ago which disclosed the foundations of one of the octagonal towers which once flanked the entrance gate. Mr. Winder read an interesting paper upon Sheffield Manor, from which we learn that "The Lodge," the Manor Lodge or Manor Castle (by which latter name it is now locally known) was the country mansion to which the Earls of Shrewsbury retired from time to time when the sanitary conditions of Sheffield Castle rendered a removal desirable. Thus Shrewsbury writes:—"I thought to remove this Queen to my Lodge for five or six days to cleanse her chamber, being kept very uncleanly." No remains of the Castle of Sheffield exist, but it was situated at the confluence of the rivers Sheaf and Don, and extended to Lady's Bridge, and probably to Castle Folds, Exchange-street, and Waingate, a site now occupied by warehouses and the station, hotel, and other buildings belonging to the Great Central Railway Co. The Castle is described in the Charter of Henry III., by which Thomas de Furnival was empowered to make a firm and embattled castle as "his Manor House at Sheffield," and the buildings now known as the "Manor" are at a somewhat later date described as the "Manor Farm." The Manor Lodge was situated in the centre of Sheffield Park. This park is now partly built over; the remainder is laid out for agricultural uses. The park contained about 2,462 acres, and as early as the time of King Stephen, was probably a conserve for deer. When the mansion was deserted, the stock of deer decayed, but even in 1637 there were still 1,000 fallow deer and 200 "deer of antler." in it. The park was famous for its long, straight avenue of walnut trees, which led from the gate of the park next the town to the principal entrance of the manor, and for its numerous and immense oak trees. The manor house is reputed to have been built by George, the fourth Earl of Shrewsbury, at the commencement of the sixteenth century, probably prior to 1516. It was maintained for some forty or fifty years after the destruction of Sheffield Castle during the Civil Wars, but in 1706 was dismantled by Thomas, Duke of Norfolk, since when it has been allowed to fall into almost irreparable ruin.

The main entrance to the court is said to have been situated between two octagonal towers on the western front, where a noble flight of steps led to the door which opened into the great gallery. This was the "faire gallerye" at the end of which, we learn from George Cavendish, the gentleman-usher to Wolsey, was "a goodlie tower with lodgings where my lord was lodged," and that it was large enough when divided by a "travers of sarcenett," "which was drawn across it," to accommodate the Earl of Shrewsbury at one end and the great cardinal at the other, during the time of his visit of sixteen or eighteen days from November 8, 1530, when on his way to London, which place he never reached, dying, as history relates, at the Abbey of St. Mary, at Leicester. The only other event of historical importance connected with the manor is the detention here of Mary Queen of Scots, for whose safe keeping it is related George, Earl of Shrewsbury, in 1577, erected a separate building, now known as Manor Lodge. It stands at some little distance from the west front of the ruins of the Manor House, and takes the form of a square three-storied building. The members wended their way up the spiral stone staircase to the two chambers—one the guard-room, the other the apartment occupied by the unfortunate Queen, which has an elaborately panelled and decorated plaster ceiling and a richly-carved over-mantel and fireplace. Leaving behind them the memories connected with the past history of Sheffield Manor, the party returned to the hotel to dinner, and to prepare for the evening reception at the Town Hall.

At 8.30 the Lord Mayor and Lady Mayoress entertained the members of the Congress, and a large party who had been invited to meet them, at a conversazione at the Town Hall, and during the evening the President, Mr. R. E. Leader, B.A., delivered his inaugural address. The President said that, during the thirty years which had passed since the previous visit of the Association, the place had seen great changes. From a town of some 200,000 inhabitants, it had developed into a city of over 450,000. Its central streets had been reconstructed almost beyond recognition, and the remorseless extension of its boundaries had been accompanied by a lamentable sacrifice of beautiful surroundings and the submerging of many old landmarks. In a lengthy and carefully-prepared and very interesting address, of which we can only give a very brief summary, Mr. Leader dealt with the history of Hallamshire, saying that it was with true archæological instinct that Mr. Hunter, the historian, made his great work the history of Hallamshire, and not the history of Sheffield. Its topography is the key to its history; the slopes that rise from the confluence of the Sheaf and the Don, buttressed by a rampart of hills and wild moorland, and girdled with primeval forests, remote on the only accessible side from the great tide of life, formed an ideal place of settlement when might was right, and, in consequence, the part played by Sheffield in the events of national history has been but small. The clash of arms has only twice been heard within its borders. As an obscure episode, in the Barons' wars, De Furnival's Castle was burnt in 1266, if it were indeed a castle. There is no doubt, however, as to the reality of the castle which in 1644 was besieged by and surrendered to the Parliamentary forces. These two events, said Mr. Leader, so far from impugning the demonstration of the teaching of the seclusion of Sheffield, strengthen it distinctly, because the intrusive castle, not the town, was in both cases the object of attack. The hostile forces turned out of their way to reduce a structure which, though militarily obscure and unimportant, might be troublesome. The imprisonment here, for fourteen years out of eighteen, of Mary Queen of Scots was undoubtedly owing to its seclusion. It combined the publicity which made attempts at rescue hopeless, with the obscurity engendering forgetfulness. "Out of sight, out of mind," was Elizabeth's hope. The nestling retirement of situation once more stood Sheffield in good stead when, in 1745, Prince Charles Edward passed south with his rugged following. Although heralded by frenzied stories of bloody atrocities marking their path, the unkempt rabble passed on their way without turning aside into Hallamshire, and, apart from any "moral and intellectual damage" caused by the raid, the loss suffered by Sheffield may be appraised at 7*d.*, the amount of the fee paid to the bellman when sent round by the Cutlers' Company to recall the Corporation to a meeting, put off "on account of the rebels being near us." No opportunity for conviviality was ever lost, and in a few months Culloden afforded legitimate excuse for rejoicings at The Cock, accompanied by an expenditure of 1*s.* 7*d.* for beadles' cockades and of 3*d.* for tobacco pipes. Thus Sheffield emerged from the crisis cheaply and without the inconvenience which more obtrusive towns had to undergo. The cutlery manufacture, for which Sheffield is so famous, dates from 1340.

Tuesday, August 11.

Members and friends were off betimes by the 9.12 train from the Great Central, Victoria Station, to Worksop, which was reached about 9.45, whence carriages were taken to Blyth for the inspection of the grand Norman church, of which a good description and history was given by Dr. John Stokes, Hon. Local Treasurer. Blyth is situated on the border line of Nottinghamshire and Yorkshire, and is a pleasant old-world village of little importance, though of ancient parentage, for it is mentioned in Domesday. The church was founded in 1088 by Roger de Busli, and the Norman arcade, with triforium and clearstory, are of grand proportions. In 1287, a dispute having arisen between the parishioners and the monks of the Benedictine Monastery of St. Mary, Blyth, a cell of St. Trinité, Rouen, the south aisle was enlarged and became the parish church, and a wall of partition was erected to separate the rest of the church to the use of the monks. The nave was originally much longer, and remains of the foundations of the apsidal end may yet be traced. On the walls of the nave some tracings of painted decoration of the twelfth century still remain. Some good late fifteenth century screenwork remains in the south aisle, still used as the parish church, the chancel screen being vaulted, the lower panels painted with figures of saints, representing St. Barbara, St. Stephen, St. Euphemia, St. Edmund, and St. Ursula. The tower at the west end is about 70 ft. high, and was added in the fourteenth century. In the chancel is the much mutilated effigy, said to be of the founder of the church, Roger de Busei, but of a much later date, and probably commemorating a crusader. Two old collecting boxes of oak, dated 1661, are preserved in the church.

Resuming the carriages, the party returned to Worksop, and proceeded to view the church, which, after the vicar had given some particulars of the manor, Mr. Charles Lynam, F.S.A., described. The nave and side aisles are all that now remain of the richly-endowed church of the Monastery of the Canons regular of St. Augustine of Worksop, which was founded in 1102 by William de Lovetot, and dedicated to SS. Mary and Cuthbert. The monastery was dissolved in 1539, being the second of the larger monasteries to fall under the ban of the king. It was founded for fifteen canons. With the aid of a capital block plan, Mr. Lynam pointed out the situation of the church and conventual buildings in relation to the river, which here, as in other cases, was the determining factor in the choice of the position, and here necessitated the buildings being placed on the north side. The church was both parochial and conventual. The founder placed the canons in a church which was existing at the time of his intention, in 1103, to found the monastery, but the actual foundation seems to have been de-

ferred, as the date of the charter is between 1123-1139, and Mr. Lynam considered the date of the building to be later than the earlier one assigned to it. Worksop Priory Church is so well known to architects and readers of the *Builder* that to descant upon its architecture seems unnecessary.

It was a cruciform church of large dimensions, with central and western towers; the latter only remains, and was so grand and imposing that Henry VIII. considered it to be suitable for the cathedral of one of his proposed new dioceses. An unusual feature in the interior is that the clearstory windows are not over the arches, but partly over the walling and piers of the nave. Having inspected the ruins of the beautiful Early English Lady-chapel, which was attached to the east side of the south transept, and erected probably about 1240, the party proceeded to the gatehouse, a very picturesque and fine example of a priory gate-house. From its size and internal arrange-ment of hall and chambers on the upper floor, it probably served as the guest-house for ordinary travellers. The period of its erection is within the first quarter of the fourteenth century. Near the gateway are the steps and part of the shaft of the old market cross at which, in olden times, the King's proclama-tions were wont to be made; and it is said that, in the days of the Commonwealth, banns of marriage were announced from the steps of this cross. After luncheon the carriages were again in requisition for the drive to Steetley to inspect the beautiful little chapel of Tran-sitional Norman architecture. The Rector of Whitwell, Rev. Canon Mason, in whose parish Steetley now is, although formerly it was a separate parish, described the building, and gave some interesting par-ticulars of its early and recent history, for until 1880 it had been allowed to lie roofless and uncared for. The chapel consists of nave, chancel, and sacrarium, with apsidal end. The chancel arch is well proportioned, in two orders, and is richly decorated with chevron and other ornaments, and a broad moulded label having an escalloped margin filled with small cones. The capitals of the shafts on the north side are carved, and repre-sent the contest between St. George and the Dragon; those on the south side are much plainer, being simply escalloped. The inner side of this arch is simply moulded, without ornament. The arch of the sacrarium and the vaulting rits of the apse are less enriched, while the capitals of the shafts of the arch and first rib are richly carved with foliage, the other rib and cap are only escalloped. The date of this charming little building may be attributed to the middle of the twelfth century. Some remains of colour are visible on the ornamentation of the ribs of the apse. Barlborough Hall was the next place on the day's programme, a charming Eliza-bethan manor house, but little touched in the way of restoration, and in admirable preservation. The hall was described by Mr. J. R. Wigfull. The hall was built in 1583-4, by Francis Rodes, a Justice of the Common Pleas, and is inhabited now by a descendant, in Miss de Rodes, to whose courtesy the party was much indebted for permission to view the house and its beautiful gardens. The house is square in plan and somewhat resembles Bolsover; the rooms are but little modernised and are full of ancient furniture, rare cabinets, and antiquities, paintings, and other works of art of great value. The carved stone mantel in the drawing room is a fine piece of work with figures representing Francis Rodes, his two wives and other ladies. The fire back to the grate is dated 1616 with the initials I.R., and was put in by John Rodes the son. In the dining-room is another handsomely carved overmantel dated 1697. The library is small, but, in it are exhibited some valuable MSS. and autographs of Henry VIII., Bess of Hardwick, Elizabeth, with date 1586, Devon-shire, 1671, and others. Leaving this interest-ing old house with regret, the party proceeded to Kiveton Station for train to Sheffield. It was so late when the members reached Sheffield, tired and hungry, that the evening meeting was abandoned.

Wednesday, August 12.

The archæologists left the hotel about 10 a.m. in carriages for Beauchief Abbey, which was described by Dr. John Stokes. Beauchief has suffered greatly from spoil and ruin, and the western tower, with a small portion of the nave, are about all that now remain. The tower was fitted up with high pews of different shapes and sizes, and used as a church, about 1632, and it remains in the same condition now. The tower, which is large and massive in character, was built early in the thirteenth century, but the great win-dow, now blocked up, and the bold projecting buttresses were additions in the following century. No remains of the conventual build-ings exist above ground, but they were situated to the south of the church. The abbey belonged to the Premonstratensian Canons, and was founded in 1172 by Robert FitzRanulph, who was one of those concerned in the assassination of Thomas à Becket, and in expiation of his share in that deed, founded this abbey, and dedicated it to the saint. This was one of the small abbeys whose revenues were under 200*l.* per annum, so it was dis-solved in 1536.

Chesterfield was next visited, where the fine church, with the celebrated crooked spire, was described by Mr. R. T. Gratton. The church was built in 1350, and the foundation stone was laid by Edward the Black Prince in the presence of the King, Edward III. Mr. Gratton pointed out the chief features of the building. Of the church, if one existed, in Norman times no trace remains, and there is no mention of Chesterfield in Domesday; but, according to Dr. Cox, "one must have been erected almost immediately after the con-clusion of that survey, for William Rufus, who died in the year 1100, gave the church of Chesterfield, together with its chapels, to the Dean and Chapter of Lincoln." The oldest portions of the present church are to be seen in the transepts, where are remains of Early English work, but the greatest portion of the fabric now remaining must belong to the Decorated period and can scarcely be earlier than 1350. There are numerous monuments in the church, many of which have been removed from their original positions, probably about 1688, as they are reversed in position, facing west instead of east, which was the pre-Reformation position for all monuments except clerics, which, said, Mr. Gratton, were placed facing west (and presumably they were so buried) the idea being that they should face their flocks on rising at the Last Day. The lines of the old roof are clearly defined on the east wall of the tower. The church con-tains much old woodwork in screens and reredos of the Perpendicular period, and there is a handsomely-carved black oak pulpit of about the period of James I. Pre-served in the church is a large iron-bound chest at the east end of the south aisle, probably of sixteenth century date, and a fine font, carved, with circular bowl, and of the Norman period. After luncheon, Winfield Manor was visited, being described by Mr. J. B. Mitchell-Withers. This extensive and most interesting manor-house is now a com-plete ruin, but its plan, in the main, is quite easily decipherable. The building formed two courts, the principal apartments being situated in the inner court. The first court faced the south, the other the north. The entrance to the outer court was by an arched gateway on the east side. The building was probably erected about 1441-3, and was built by Lord Cromwell, Lord Treasurer to Henry VI., and in the carved coat of arms over the gateway are a number of purses representing his office of Treasurer of the Exchequer. Beneath the great hall, and of the same dimensions, but divided by two rows of octagonal columns which support a groined and vaulted roof, is a large apartment, fairly well lighted, and con-nected by broad stone stairs and passages with the upper floor. What was the use of this apartment is uncertain. It appears to have been of the same date as the superstructure, and has been thought by some to have been the chapel, particularly as the chapel has not been satisfactorily located; but it seems to be more likely, from its ease of access from other parts, that it was a second hall, for the use of the retainers of the household of those of the many guests of the noble owner of the mansion. The hall was not completed by Lord Cromwell, as he sold it to John, second Earl of Shrewsbury, in whose papers are many references to payments for the construction of the building, and in the possession of the Earls of Shrewsbury the hall continued until 1616, when it passed, after some family negociation, into the possession of the Earl of Pembroke. The chief event in the history of Winfield Manor is the captivity of Mary Queen of Scots, who passed a great part of her imprisonment of nineteen years at Winfield and Sheffield. Nothing now remains of the buildings which were occupied by the Queen and her retinue, but foundations on the west side of the inner court are said to indicate the position they occupied. During the Civil War Winfield was taken by storm by the Royalists, but, later on, was recaptured by the Parliamentarians, and was under a Decree of Parliament, dated June 23, 1646, dismantled and reduced to the ruin we now see. There are some charming bits of architectural detail to be met with about the ruins, and the whole grouping of the buildings must have been most picturesque. As this was a long day, and members could not return to Sheffield until late, no evening meeting had been arranged for.

Thursday, August 13.

Leaving the Royal Victoria Hotel in car-riages about 9.45 members and visitors drove to Wincobank Hill and devoted some two hours to an exploration of the pre-Roman camp there situated. By direction of the Museum Committee and under the personal superintendence of Mr. E. Howarth, F.R.A.S., F.Z.S., the curator, and one of the local hon. secs. of the Congress, explorations have been made recently, and cuttings through the earth banks and into the central mound were open for the inspection of the archæologists. After a somewhat steep climb up the hill, from which a fine view of the surrounding country on one side, and the smoking furnaces and chimney-shafts of the many iron and steel works of Sheffield on the other side, was ob-tained, Mr. Howarth described the investiga-tions that had been made and the results that had been obtained. He said it would be almost impossible at present to assign an authentic date to the rampart which surrounded the natural mound. It was, however, a stone rampart and not an earthen one. In the section which had been cut through for the inspection of the members of the Congress, it was plainly seen that the stones forming it had been placed in layers of varying sizes and thicknesses, but without mortar of any kind. The bottom of the rampart had been made smooth, and the stones piled up with regu-larity, sloping upwards at an angle of about 45 deg. The outer rampart, which extended on all sides but the north, was of earth. On the north the natural slope of the hill is much steeper, and, presumably, a rampart was not considered necessary. The camp was oval in formation, 150 yards by 120 yards, and it had four chief entrances. Many burnt stones and much charred wood had been met with in the excavations. It does not appear to have been an occupied camp, but a camp of refuge in sudden danger. The camp was no doubt for some time held by the Romans, and pieces of Roman pottery had been met with, but it bore no resemblance to a Roman camp, and must have been constructed by an earlier people. Jet had been found, which was often used by the Britons, and a few pieces of flint had been met with, and as flint was not natural to the site it must have been brought there by people who used flint. Mr. J. C. Gould considered the date of the camp to go back at least 500 years before the invasion of the Romans. Celts, he said, usually fixed upon a hill which was more or less flat-topped; this was a ridged hill, and from his experience he was led to believe that a camp with a "hog back" was earlier than one flat-topped. They had an illustration of that in Mam Tor. With regard to the preservation of the camp from further encroachments and injury, it was resolved to appeal to the Duke of Norfolk, the owner of the property, that steps might be taken for its protection. Leaving Wincobank, a short drive brought the party to Ecclesfield, where the fine old church, known locally as the "Minster of the Moors," was described by the President, Mr. R. E. Leader. Domesday does not mention a church at Ecclesfield, and no traces of a Saxon or Norman church have been met with, but, a little later, about 1141, one of the Love-tots, who founded the church at Sheffield and the priory at Worksop, founded a church here; it has, however, entirely disappeared. In the reign of Henry I. a church must have existed, as another of the family of de Lovetot bestowed it with lands upon the Abbey of St. Wandrille in Normandy. Towards the end of the twelfth century the monks of St. Wandrille erected a priory and placed some of their order in it. In 1310 the Archbishop of York ordained that the monks should present the vicar of Ecclesfield,

and an uninterrupted line of vicars has ever since been continued to the present day. There are only a few trifling remains of the Early English church. At the suppression of the alien priories this church was transferred to the monastery of St. Anne, at Coventry, and the chancel was built by the monks of that establishment. The church is almost wholly of the Perpendicular period, with a lofty tower. Some remains of the buildings of St. Wandrille's Priory remain, and have been converted into a curate's house ; they are of late date. In 1386, the estates were farmed out amongst the inhabitants of the village. Richard Dodsworth visited the church in 1680, and was much impressed by its stateliness and the painted glass then in the windows. It was he who called the church the "Minster of the Moors," a name it has ever since retained. The plan of the church is precisely the same as that of Sheffield Parish Church, of the fifteenth century, before the alterations, as was pointed out by Mr. Wigfull. In the south chapel there is a very fine monument with recumbent effigy of a Sir Thomas Wentworth. The church is rich in carved woodwork in the chancel screen, choir stalls with returned ends, and bench ends terminated with curious little figures in attitudes of adoration. There are also screens to north and south aisles of fifteenth-century work of good character. In the north aisle is preserved an ancient chest of great size, iron bound, and having four locks. At the west end of the south aisle is preserved the portion of the stem of an early cross set on a base stone which has the socket of a second cross beside it. The cross is seemingly pre-Norman. In the churchyard are some interesting monuments, including one to the memory of Dr. Scott, in whose arms Nelson died at Trafalgar. Joseph Hunter, the historian of Hallamshire, is also buried there.

From Ecclesfield the members returned to Sheffield to luncheon, and in the afternoon were entertained at a garden party at Queen's Tower by Mr. Samuel Roberts, M.P., D.L., M.A., and Mrs. Roberts.

The evening meeting was held at the Weston Park Museum, where Mr. E. Howarth, the Curator, and some members of the Committee, received the party. Mr. Howarth described the celebrated Bateman Collection of antiquities and other objects of local interest. During the evening a paper was read by Dr. Birch for the author, Mr. W. J. Nichols, upon his discoveries in the caves and dene-holes at Chislehurst, in Kent. The paper was illustrated by many beautiful large-sized photographs.

Friday, August 14.

The weather, which had hitherto been fine, changed to-day, and it was in heavy rain that the members of the Congress set out in carriages, about 10 o'clock, for a long driving day. Carbrook Hall, in the outskirts of Sheffield, was the first place visited. It is now used as a licensed house, and is full of quaint carving and panelled ceilings. Mr. Wigfull, in describing it, said it was the property of the Bright family, and was built in the early part of the seventeenth century by Stephen Bright. One of the sons of the family had been Governor of Sheffield Manor and a Colonel in the army. Rotherham was next reached, and the fine church of All Saints was described by Mr. E. Isle Hubbard. There was probably a church here in Saxon times, as Rotherham was a manor before Domesday, but there are no evidences remaining. That there was a church in Norman times they had knowledge from the foundations discovered at the restoration in 1873, and from the remains of masonry of that period of grey magnesian limestone in capitals and bases. The tower was older than the nave, and showed the water tabling marking the pitch of an earlier roof. The chancel inclines slightly to the south. The clearstory windows are additions of the sixteenth century, and at that time the chancel was lengthened. The old Norman bases of the piers are seen below the floor, openings having been made in the flooring for the purpose. In one or two instances inverted capitals of that period have been used as the bases of the present diamond-shaped piers of late sixteenth century date. In the south chapel there are some richly-carved stalls. The tower is vaulted with fan-vaulting, which is an unusual feature in this part of the country. Archbishop Rotherham, who died in 1500, largely contributed towards the building of the church, and many bequests to the town were also made by him. An interesting fresco once existed over the western arch of the tower, but was unfortunately destroyed, not, however, before an accurate copy in colour had been made of it, which Mr. Hubbard exhibited. An old Norman font, much decayed, is preserved in the south chapel. The church registers date from 1541. Leaving the church, a brief visit was paid to the ancient Bridge Chapel, which was originally dedicated to Our Lady for the safety of persons crossing the bridge. This Bridge Chapel is one of three existing in England, and is one of the most interesting archæological features of Rotherham. The party next proceeded to Roche Abbey, and it was intended to have taken lunch in the Abbey grounds, but the inclement weather prevented all but a cursory glance at and hasty perambulation of the ruins between the heavy showers. The Rev. H. J. Dukinfield Astley, hon. editorial secretary, described the plan of the Abbey under the shelter of the gateway, and deferred his paper upon its history until the evening. From Roche, the members drove on to Laughten-en-le-Morthen, and visited the interesting old church with undoubted Saxon doorway on the north side, and other remains of the church which existed on this site in Saxon times. The Rev. Thomas Rigby, the Vicar, described the building, and gave some account of the history of the parish. In the December number of the volume of the *Journal* of this Association for 1874 will be found a long and reliable article on Laughten-en-le-Morthen by the late Rev. John Stacye, M.A. The church is dedicated to All Saints, and the registers date from 1547. The ancient altar stone with the five consecration crosses is preserved at the east end of the south aisle, together with an incised cross slab of early date. The rain having ceased for awhile, the ancient earthworks were inspected under the guidance of Mr. I. C. Gould, who gave some particulars of their construction and use, reserving further description until the evening, when he was to read a paper dealing with the subject. A little after four o'clock the party resumed the carriages for the return to Sheffield. At the evening meeting at the Town Hall the following papers were read, viz., "Roche Abbey," by the Rev. H. J. Dukinfield Astley, M.A., and "Early Defensive Works near Sheffield," by Mr. I. C. Gould. This was the concluding business of the Congress, and the usual votes of thanks to the authorities and all who had assisted to make the Congress successful were duly passed.

Saturday, August 15.

The early part of the day only was given to the proceedings of the Congress, as many members had to return to their homes. In pouring rain the party, reduced in numbers considerably, drove to Bradfield, and visited the ancient church and a curious watch-house adjacent to it. There are several indications of Norman and Early English work in the church, but the edifice is, in the main, of the Perpendicular period. The nave arcade presents a rather peculiar appearance, as on the north side the columns are circular, and on the south octagonal, and none of the piers have capitals, the arches resting on the piers in a very awkward manner. The watch-house is interesting, and has an embattled parapet, but has been modernised. The rain, which commenced again with increased vigour, prevented more than a brief, hurried visit to Bailey Hill, the ancient earthwork behind the church, which Mr. Gould was to have explained. The wind also blew with the force of a gale, rendering out-of-doors speaking inaudible. The return to Sheffield was made in about an hour, and the members dispersed after having had a very successful congress.

THE CHURCH AND CHURCHYARD OF ST. ANNE, SOHO.

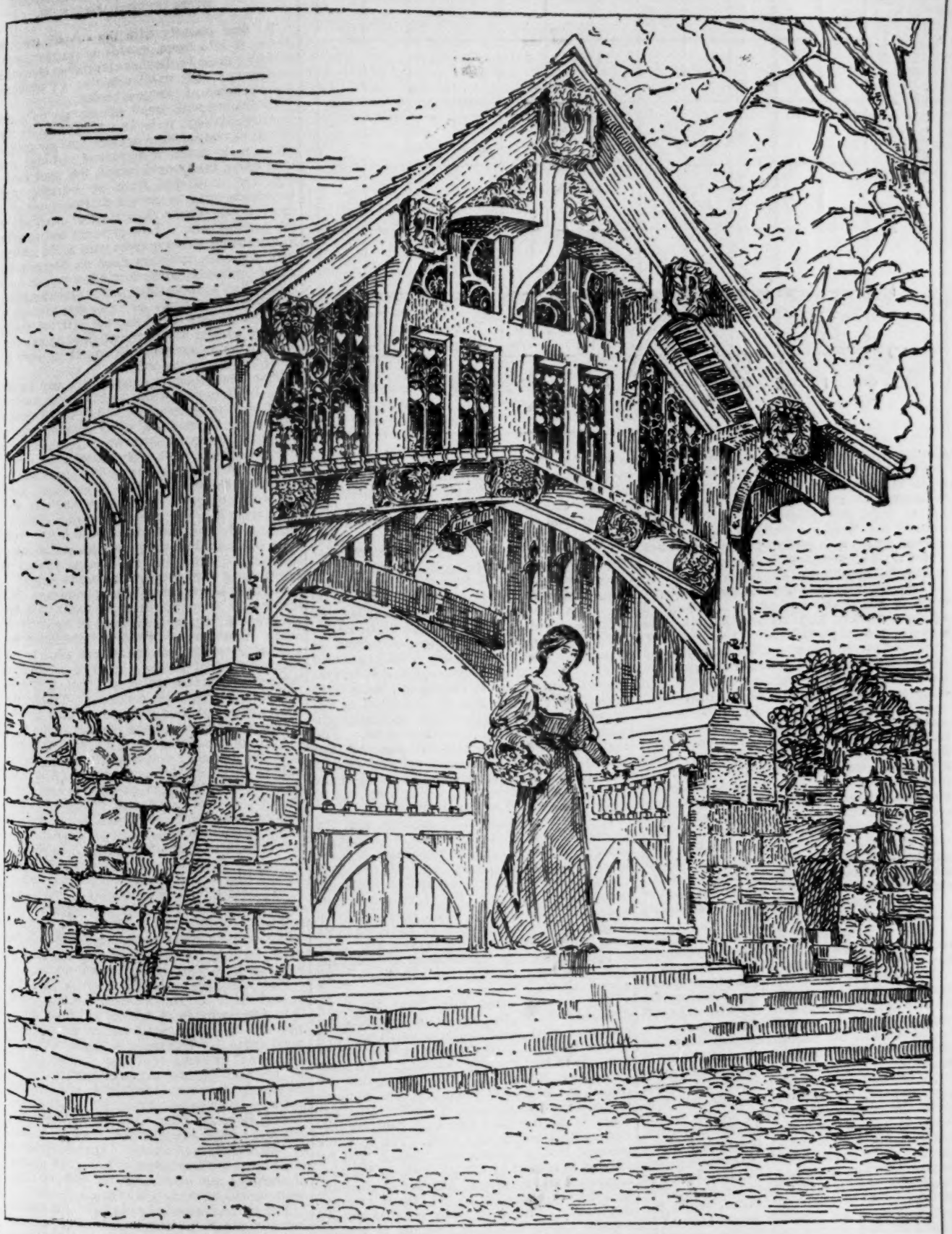
At a sitting of the Consistory Court of London in St. Paul's Cathedral last month, Dr. Tristram, K.C., Chancellor of the Diocese, granted a faculty to sanction an agreement made between the rector and churchwardens and the Council of the City of Westminster. As successors to the Strand District Board of Works the Council took over a lease of the churchyard and its management as a public garden, granted by the rector and churchwardens for a term of twenty-one years from March 25, 1892. Many years ago a vestry, mortuary, and caretaker's house were built at the east end of the churchyard. The City Council relinquished their claim to those buildings provided that the Consistory Court would sanction the granting to them by the rector and churchwardens of a lease for 999 years of a portion of the ground. The Vestry approved of that arrangement at their meeting held on June 12, and it is now confirmed by the Consistory Court. The faculty will provide also for the delimitation of a part of the ground for the enlargement, if hereafter found to be necessary, of the church at the west end, and for the vesting of the existing vestry, mortuary, and caretaker's residence in the rector and parishioners for purposes of the church and the conduct of parochial business. The settlement thus arrived at is satisfactory to all parties concerned, and costly litigation has been avoided. The churchyard, about three-quarters of an acre in extent, having been closed against further burials by an Order in Council of August 8, 1853, was laid out as a public recreation ground by the Metropolitan Public Gardens Association, and opened on June 27, 1892. In the autumn of 1900 the Consistory Court issued a faculty to authorise the conveyance to the Strand District Board of Works for 490*l.* of a strip of the ground, 155 ft. long and tapering from 9 ft. 4 in. to 7 ft. 4 in. in width, for the widening of Wardour-street and the building of a new west wall with steps and gates on that side. The church was built of brick on a site in Kemp's field—the ascription of the design to Wren is without accredited authority—for a parish taken out of that of St. Martin-in-the-Fields and named in compliment to the Princess Anne of Denmark. A stone on the west face, north side, of the tower records the completion of the structure in 1686. The former tower, as depicted in the view by B. Cole engraved for Maitland's "History of London," 1756, had four angle vases and carried an ogee-shaped eight-sided cupola which supported an open octagonal lantern surmounted with a concaved base bearing a bulbous-shaped spire and finial. Those portions were taken down in June, 1800. An Act passed on May 28, 1802 (42 Geo. III., c. 72), provided for the raising of 6,000*l.* by way of annuities to defray the expense of rebuilding the tower and of new vestry rooms, watch-house and engine-house at the east end, in Dean-street, the vaults, and various repairs. S. P. Cockerell carried out the work in 1802-3 ; and to him perhaps is due the present singular spire, somewhat after the Dutch style, having a copper globe for the dial-plates of the clock. The design, however, is attributed, but not authoritatively, to Henry Hakewill the elder. Sir Arthur Blomfield superintended the recent restoration of the fabric of the church. Hazlitt's tombstone is on the south side, and just above it is the monument carrying an urn which Walpole set up and inscribed in memory of Theodore, King of Corsica, who died in the parish on December 11, 1756, a few days after his release from King's Bench prison. John Wright, an oilman in Compton-street, Soho, saved the King's remains from a pauper's burial and interred them in the churchyard. There, too, was buried in 1816 David Williams, founder of the Literary Fund, which originated in a meeting at which Benjamin Franklin was present, of a small club at the Prince of Wales's, since Limmer's, tavern, in Conduit-street, Hanover-square, in 1773. The Crace Collection contains another view by B. Cole, 1754, showing the church as seen from the north, and W. Pearson's drawing, 1810, of the west front.

COMPETITIONS.

Free Library, Heywood.—The Heywood Town Council have extended the time for the drawings to be sent in in this competition, advertised in our issues for August 1 and 8, from September 14 to October 1.

Library, Bridgeton, Glasgow.—The designs by Mr. J. R. Rhind, architect, Inverness, have been accepted for the library to be erected in Bridgeton.

The International Society of Sculptors, Painters, and Gravers. — The International Society of Sculptors, Painters, and Gravers shipped from Liverpool to Philadelphia last week the collection of works by its members, numbering about 100, for exhibition in the various American academies, and galleries, including Philadelphia, Pittsburg, Chicago, Boston, Detroit, &c. ; and the collection will be shown in the St. Louis Museum during the Exhibition next year.



Lych Gate, Bramham. Messrs. Bromet & Thorman, Architects.

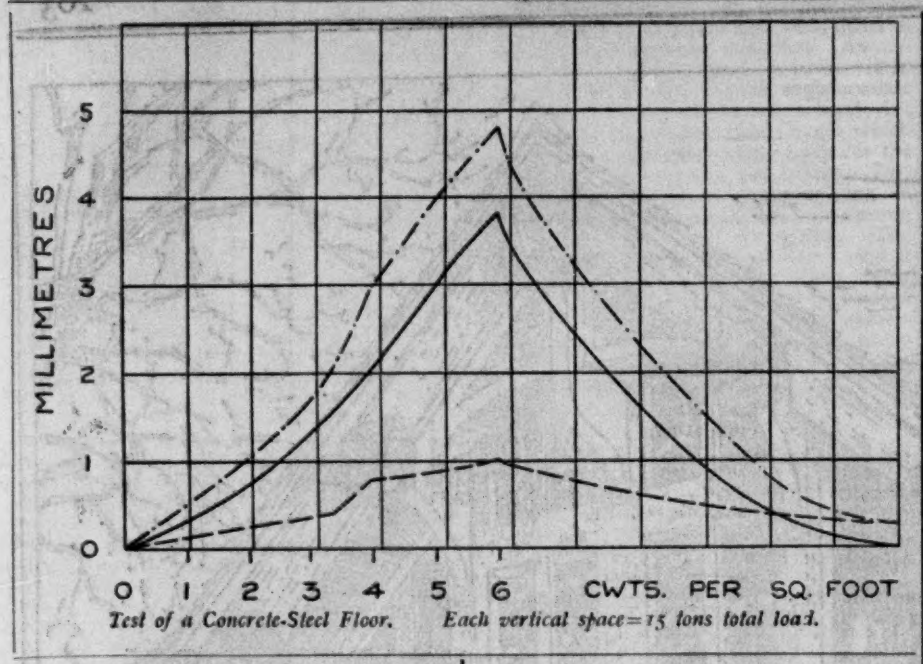
BRAMHAM LYCHGATE.

THE new lychgate given by the Right Hon. J. L. Wharton, M.P., to Bramham Church is made out of very massive oak framing, with delicate tracery panels, and rich carving on limestone walls, and roofed with red tiles. It was designed by Messrs. Bromet & Thorman, Tadcaster; Mr. R. Hedley, of Newcastle, did the woodwork; and Mr. A. Thompson, of Sherburn, the masonry, &c.

A brass plate inside bears the following inscription:—"Hanc Portam in Memoriam Eorum quos vivos amavit et in spe bona futuri posuit J. L. Wharton, A.D. 1902."

TEST OF A CONCRETE-STEEL FLOOR.

A PRACTICAL illustration of the suitability of concrete-steel for warehouse buildings is afforded by a floor recently completed under the "Hennebique" system at Messrs. Whitbread & Co.'s storage depôt in Tottenham. The floor in question has been constructed in an extension of a previously existing warehouse, and covers an area measuring 123 ft. 2 in. by 25 ft. 7 in. The new building comprises a basement and three floors, the ground floor being that to which we now direct attention. Support for the main beams is furnished by the brick walls of the building, and as the inner or south wall is only 14 in. thick, a continuous beam, or lintel, of concrete-steel has been inserted below the ends of the main beams, for the purpose of distributing the load equally over the entire length of the brickwork. Blocks of stone are let into the outer walls to perform a similar duty on a less extended scale. The lintel is 14 in. wide by 10 in. high, and includes three pairs of $\frac{7}{8}$ in. diameter tension bars, three bars being near the upper surface and three near the lower surface, each pair of bars being joined vertically by "stirrups" of steel, 2 in. wide, the thickness varying from No. 12 to No. 15 S.W.G., according to requirement. The



Test of a Concrete-Steel Floor. Each vertical space=15 tons total load.

stirrups are for the purpose of resisting shear, and the lintel is further strengthened by ¼ in. diameter transverse rods. The main floor beams, spaced 11 ft. 3 in. centre to centre, are 14 in. wide, and project 22 in. below the underside of the floor, which is 5 in. thick and finished on top with cement paving 1½ in. thick. As the floor is continuous in every direction, it practically constitutes an upper flange for the whole of the beams. The steel reinforcement in the beams consists of four pairs of 1⅜-in. diameter bars in the tension area, stirrups being placed round each pair and continued to the upper portion for withstanding shearing stress. Above each beam, and embedded in the floor slab, is a series of ⅞-in. diameter rods, 5 ft. long, and spaced 12 in. apart, for the transmission of stress, so as to avoid any element of weakness at the junction between the beams and the remainder of the floor. The floor joists, spaced 5 ft. 3 in. centre to centre, extend from beam to beam, and measure 5 in. wide by 9 in. deep, below the underside of the floor, the steel reinforcement consisting of two 1-in. bars in the tension area, with stirrups as before mentioned. The floor slab is suitably reinforced, and the steel generally is so disposed that the several elements of the floor are combined to form a single structure. The floor has a clear span of 25 ft. 7 in. between the walls, and no supporting columns are employed.

These are the main features of the floor recently completed, of which one complete bay of 288 sq. ft. area was tested on July 30.

The floor was calculated for a superimposed load of 4 cwts. per square foot, therefore the normal test load was 57 tons 12 cwts. The test was conducted in the following manner:—Instruments for the measurement of deflection were fixed in position below one of the main beams, one instrument at each end, 1 ft. away from the wall to indicate compression of the supports, and one instrument at the centre to show the maximum deflection of the beam. At 11.25 a.m. loading of the floor was commenced, the weight being distributed along the axis of the beam until the calculated superimposed load of 4 cwts. per square foot was reached. Readings were taken for increments of load up to fifty tons, and again when the load was equal to 4 cwts. per square foot. The total deflection for the normal load, measured in millimetres, was 2·9 mm. at the centre, the average of the deflection of the piers being 0·85 mm., giving a real deflection of the beam of 2·05 mm. or $\frac{1}{1250}$ of the span. An additional load of 2 cwts. per square foot was then imposed, and further records were taken. The total load of 86·7 tons, equal to 6 cwts. per square foot, was completed at 3 p.m. and allowed to remain in position for one hour, when the total deflection was found to be 4·8 mm., the average of the deflections of the piers being 1 mm., thus giving a real deflection of the beam of 3·8 mm., equal to $\frac{1}{675}$ of the span.

At 4 p.m. the removal of the load was commenced. This operation was finished by 5.25 p.m., when the deflection was 0·35 mm. at the centre, 0·65 mm. at the north pier, and 0·05 mm. at the south pier, or an average of 0·35 mm. deflection at the supports, showing that at that time the deformation was entirely elastic. At 7.25 p.m., two hours after the removal of the load, the readings were:—Centre, 0·3 mm.; north pier, 0·6 mm.; south pier, 0·0 mm. It was therefore evident that the beam had entirely recovered its original form, and, further, that there was no permanent deformation of the support strengthened by the concrete-steel lintel. No cracks or fissures were observed during the course of the tests.

In the diagram which we reproduce is shown the history of the test from beginning to end. The top curve gives the total deflection as read from the centre instrument, the bottom curve indicates the average deflection of the supports, and the middle curve represents the actual deflection of the beam itself. The vertical lines in the diagram intersect the curves at intervals of 15 tons total load on the bay of 288 sq. ft., but for convenient reference we have also shown the load in cwts. up to the maximum of 6 cwts. per square foot.

It may be interesting to mention that the front wall of the new storehouse at Tottenham is supported by a concrete-steel beam or lintel extending in a single span from side to side of the building, the weight carried by this lintel being about 95 tons. Its chief dimensions are 25 ft. 7 in. span, by 18 in. deep, by 16 in. wide. There are four pairs of 1¼-in. diameter bars in the compression area, and four pairs of 1⅜-in. bars in the tension area, with stirrups 2 in. wide by 12 S.W.G. for affording resistance to shear.

The concrete used throughout the work described is of the following proportions: cement, 6 cwts.; sand, 0·5 cubic yard; screened gravel, 1·0 cubic yard; making 31 cubic feet of concrete in position after ramming. We learn from the architect, Mr. Arthur Dixon, that the cost of the floor was practically the same as that of an adjoining floor of similar area, but made in the ordinary way with concrete carried by steel beams and joists. The architect believes that a considerable saving will be effected in respect of maintenance, as the concrete-steel will require no painting or cleaning as is always necessary in the case of exposed steelwork. The floor was constructed by Messrs. Cubitt & Co., of London, in accordance with the designs prepared by the architect and Mr. Mouchel, engineer to the Hennebique Company. We learn that a similar test will probably be conducted upon the adjoining steel-supported floor, and we hope to be able to give our readers the results so obtained for the purpose of comparison with the records now presented.

INDUSTRIAL SCHOOL, BLACKBROOK.—On the 16th inst. Dr. Whiteside, Roman Catholic Bishop of Liverpool, laid the memorial stone of a new industrial schools for girls, which is being erected at a cost of 10,000*l.*, at Blackbrook, near St. Helens. The building will be of red brick and Runcorn stone, and will accommodate between 120 and 150 girls. The contractors are Messrs. Roberts & Robertson, of Liverpool, and the architects Messrs. Pugin & Pugin, of London and Liverpool.

WARMING AND VENTILATING OF PUBLIC SCHOOLS.*

To deal broadly with the subject, we may divide it into three groups or sections, subdividing these for further elucidation as may be necessary: (*a*) small schools; (*b*) medium-sized schools; (*c*) large schools.

In dealing with small schools, say up to 400 accommodation, it is found difficult, on the score of initial cost as well as permanent up-keep, to instal a system of warming and ventilating that would satisfy the most exacting, but a simple form of warming and ventilating may be carried out that would give much better results than is often practised at the present time. Low-pressure hot water or low-pressure steam may be used as the heating medium with radiators fixed on the external walls, preferably under a window remote from the seating accommodation, the radiators being supplied with fresh air passing through a louvred grating fixed on the internal walls, with a handle arrangement fixed thereto for the teacher to operate, thus admitting more or less fresh air as desired.

The ventilation (or extraction) may be by flues built in the walls in the most suitable positions, rising upwards and discharging into the outer atmosphere, or descending into a common horizontal duct which communicates with a vertical shaft. The latter plan is preferable, however, because it has been found by practical experience that "siphonage" goes on when numbers of flues go upwards and discharge into the outer air. Practical knowledge and experience have proved that such flues often act in a contrary direction, allowing the air to come into the rooms instead of performing their proper function as outlets.

In large schools where the numbers of children vary from 800 and upwards, and the classrooms become congested at times by the large numbers of children assembled for special purposes, the author has come to the conclusion that nothing short of mechanical warming and ventilating will suffice to keep the air in a healthful condition. Taking the best air as we find it, having three to four volumes of CO_2 in 10,000 volumes, it has been the aim of the author to get as near this standard as possible; and whilst it is not practicable to obtain it in many of our industrial cities and towns, it has been possible to keep down the CO_2 to 6 and 1 volumes per 10,000. This is good practice, but our aim should be to do more where the initial cost and maintenance are not considered a vital matter. In passing, the author wishes to compliment the Bradford School Board upon its militant policy in respect to good warming and ventilating. The time is not far distant, if it has not already been reached, when the results of this vigorous policy will be manifest in those who have the good fortune to be housed and educated in some of the schools of the city referred to.

The standard volume of air should be, according to the author's experience, not less than 1,700 cubic ft. of air per child per hour, and the maximum need not be greater than 2,000 cubic ft. The speed of the incoming air should not exceed a velocity of 5 ft. per second on an average over an inlet grating. This may seem to be a considerable requirement, but it is easily to be obtained by insisting upon having large air ducts, vertical flues, and inlets into the rooms of ample area, and large fans to run evenly and slowly. These desiderata must be at the foundation of any good system of warming and ventilating, and without them failures will be many and obvious.

The air inlet should be of ample size, and its location should be determined with a view to obtaining the air supply from the best and purest source near the school buildings. It should lead up to a filter, the design of which may be left to the engineer, as there are several good forms in the market at the present moment. The author has used jute and coke, with a water spray attached, to clean the air as it is passing into the school buildings; but the spray should be used with judgment, as it is likely, if used freely, to make the air too humid, and many medical men and scientists object to the incoming air being overcharged with moisture. It is not always realised that in this country the air has sufficient humidity in itself, and seldom requires moisture added to it

* Part of a paper by Mr. D. M. Nesbit, M.Inst.M.E., read on the 8th ult. at the Conference on Hygiene and Public Health in connexion with the Sanitary Institute Congress at Bradford.

unless it is being heated. During winter months, when the air must be warmed, it should be moistened, after passing through the steam batteries, by means of a jet of steam or water fixed just behind the heating surface. In installations where the heating agent is high-pressure steam, or high-pressure water, however, it is necessary to add moisture, as the air in its normal state, passing over highly heated surfaces, such as steam at 20 lbs., 30 lbs., and 40 lbs. working pressure (temp. 259 deg., 274 deg., 287 deg. Fahr. respectively), loses much of its vitality, and may be said to be burnt. The author does not use steam at such pressures, but adopts the maximum pressure on the boiler of 5 lbs., which is equal to 228 deg. Fahr., and frequently steam at 0 lb. to ½ lb. and 1 lb. not exceeded is used, and a perfect circulation is obtained.

To effect this ideal system, much care and thought must be given to the design of the apparatus, and large boilers, pipes of large internal diameter, and heating surfaces of ample power must be used to obtain the best results. These requirements may somewhat militate against the scheme at first sight, but when all things are considered, and when the maintenance is taken into account, the disadvantages of first cost are far outweighed by the easy working and permanent up-keep of such an installation. The leading ducts should not be less than 6 ft. to 6 ft. 6 in. high to allow the management, the teachers, and caretaker to walk in them freely. This also enables the ducts to be kept scrupulously clean, and regular inspection would prevent the use of the ducts for the storage of lumber, and be a security against the thoughtless deposit therein of rubbish, the presence of which must vitiate the air—possibilities which, as the experience of the author has shown, are by no means remote, but easily averted. The vertical fresh-air flues should be so arranged as to be easily "get-at-able" from the bottom, finally discharging into the classrooms about 8 ft. to 9 ft. above the floor line.

The ducts and vertical flues should have smooth surfaces, so as to give as little resistance to the inflowing air as possible, and prevent the lodgment of dust particles or other deleterious matter upon excrescences or irregularities. The ducts ought to be limewashed at least once a year, preferably during the school's summer vacation. The fans should be of the open-blade type, as they are easily kept in order, and cost much less to run. It is, indeed, a matter of astonishment, as in instances afforded in this city, how such large volumes of air can be moved at such small cost. The cost of running a fan 10 ft. in diameter at ninety revolutions per minute, delivering 2,115,000 cubic ft. of air per hour, is only 1·3 pence per hour. This is equal to providing the children with 1,540 cubic ft. of air each per hour. The boiler recommended by the author for this class of work is the "Cornish" or "Lancashire" type of steam-boiler, without cross tubes, but having a good grate surface, so as readily to form steam of *low* pressure, as it must not be *forgotten that it is not pressure of steam* that is required quickly, but *volume*.

The ventilation or extraction of the vitiated air of a school containing, say, 1,500 children, each having 2000 cubic ft. of air per hour provided for them, equals in the aggregate 3,000,000 cubic ft. of air per hour, and weighs 60,000 lbs.—or nearly 27 tons weight of air—to be dealt with every hour the school is in session, and obviously presents in itself no mean problem. Several plans have been tried, and the "Vacuous System" has given very good results. It is all that is needed where the vertical extract shaft can be made of sufficient sectional area to deal with such huge volumes of vitiated air; but where the area of the shafts is small or restricted, then some help must be given them in order to obtain the desired result.

This may be done in several ways:—(1) By means of a cast-iron flue pipe conveying the gases from the boiler, as already described; (2) by having some heat, either by steam or hot water, at the base of the shaft; (3) by having a fan fixed near the bottom, or even at the top, of the vertical shaft to draw the air along the ducts and discharge it into the upcast shaft.

The latter plan, although more costly to operate, is, to the author's mind, the best, as it ensures positive extraction, and because an exact output can be determined upon and obtained any day and at all seasons of the year. It also has this advantage, that if anything goes wrong with the Plenum fan, the ventilation would still be going on in a modified form until such time as the fan for propelling the fresh air into the building could be put into proper action again.

The fans may be driven by steam, by a gas-engine, or by electric motors; but wherever electricity is possible it is to be recommended, as there is no noise from the motor, the speed can be regulated to suit the working conditions required, and there are no disagreeable smells to be got rid of as in the case of gas or steam engines.

THE INTERNATIONAL CONGRESS OF HYGIENE AND DEMOGRAPHY.

THE eleventh International Congress of Hygiene and Demography meets at Brussels on September 2. It was twenty-five years ago that the first of these Congresses assembled there, and since then, the Congress has met at Paris, during the Universal Exhibitions of 1878 and 1900, Turin, Geneva, The Hague, Vienna, London, Buda-Pest, and Madrid. Most of the European and some American and Asiatic Governments send official delegates to attend these congresses, and there are generally leading sanitary reformers present from twenty-five to thirty different nations. Indeed, of late, notably at Buda-Pest and at Madrid, there were far too many members. It appears that this time only twelve to fifteen hundred members are expected, whereas on former occasions there have been more than three thousand.

The Congress consists of two divisions, that of Hygiene and that of Demography, or vital statistics. The division of Hygiene has seven sections, and there will also be a sanitary exhibition. The sections are:—1. Bacteriology in its relation to sanitation. 2. Chemistry in relation to food supply, &c. 3. Technical sanitation: the sciences of the engineer and the architect as applied to hygiene. 4. Professional and industrial hygiene. 5. The hygiene of transport or travelling. 6. Administrative hygiene, prophylaxy, workmen's dwellings, and the hygiene of childhood. 7. Colonial hygiene. It is, therefore, the third sections which the architects present are most likely to attend. Lieutenant-General Docteur, Inspector-General of Fortifications, is the President of this section. The Vice-Presidents are M. Hellemens, architect, and a member of the Brussels Superior Council of Public Hygiene; M. E. Putzey's, Chief Engineer of the town of Bruxelles; and Dr. de Vancleroy, Honorary Professor of Hygiene at the Military School at Brussels, are the Vice-Presidents of the Third Section. M. Hachez, engineer, Inspector of Roads and Watercourses; M. Vandervin, Principal Engineer of the Brussels Ponts et Chaussées; and M. Walin, Principal Engineer of the Liège Ponts et Chaussés, are the three secretaries of the Section. Reports are being prepared for this Section by technicians selected for the purpose from all nationalities, and will constitute the basis of the discussions to be held. Six such Reports are announced for the Third Section. The first deals with the bacterial treatment of sewage; the second with the combined and separate systems of drainage; the third with gathering grounds for water supply; the fourth with the hygiene of public thoroughfares, on which Mr. Roechling, C.E., of Leicester, is reporter; and the fifth question is on the progress realised during the last twenty years in the warming and ventilating of public and private buildings. The reporters on this, the fifth, question are M. Etienne Herscher-Genesle, engineer, of Paris; Herr Pfützner, engineer and director of the works of Rietschel & Henneberg, at Dresden; and Professor van Rysselberghe, of the Ghent University. As considerable progress has been accomplished in respect to warming and ventilating on the Continent, this Report and the discussion to follow promises to be of considerable practical interest. The sixth question is also especially interesting to architects. It is a report on the general hygienic rules to be observed in the distribution, airation, and decoration of the interior of dwelling-houses. The reporters are M. Louis Bonnier, architect, of Paris, and Herr Christian Nussbaum, Professor at the Superior Technical School of Hanover. The choice of reporters shows the thoroughly international character of these congresses, and all who are interested in public health questions, whether as medical men, architects, engineers, public administrators, are welcome. The subscription for membership is 1*l.*, or 25 francs, which should be sent to Monsieur J. Sterckx, Chef de Bureau au Ministère de l'Agriculture Trésorier du Congrès, 3, Rue Beyært, Bruxelles. The Congress is under the patronage of the King, the Honorary Presidency of Prince Albert, and the effective Presidency of M. E. Beco, Secretary-General of the Ministry of Agriculture and Chief Director of the Sanitary Services of the Kingdom of Belgium. Professor and Doctor Felix Putzeys, 1, Rue Forgeur, Liège, is the general secretary of the Congress. Needless to say, there will be numerous excursions to different parts of Belgium, and the members of the Congress, together with their families, will enjoy many facilities of visiting places of interest on special and advantageous terms.

A DEFENCE OF THE DISCONNECTING TRAP.*

THE model by-laws issued by the Local Government Board in 1877 contained a clause which really gave legal birth to the disconnecting trap. During the last quarter of a century this trap has been upon its trial, and it is the purpose of this short paper to demonstrate that the trap has more than fulfilled the object for which it was designed. There was a time when in the popular mind sanitation simply meant the insertion of traps here, there, and everywhere. In recent years a reaction has set in, and now we find responsible men even advocating the entire abolition of the disconnecting trap. The reason for this change of front is apparent when the question of sewer ventilation is discussed, for it is sought to ventilate the sewers through the house drains.

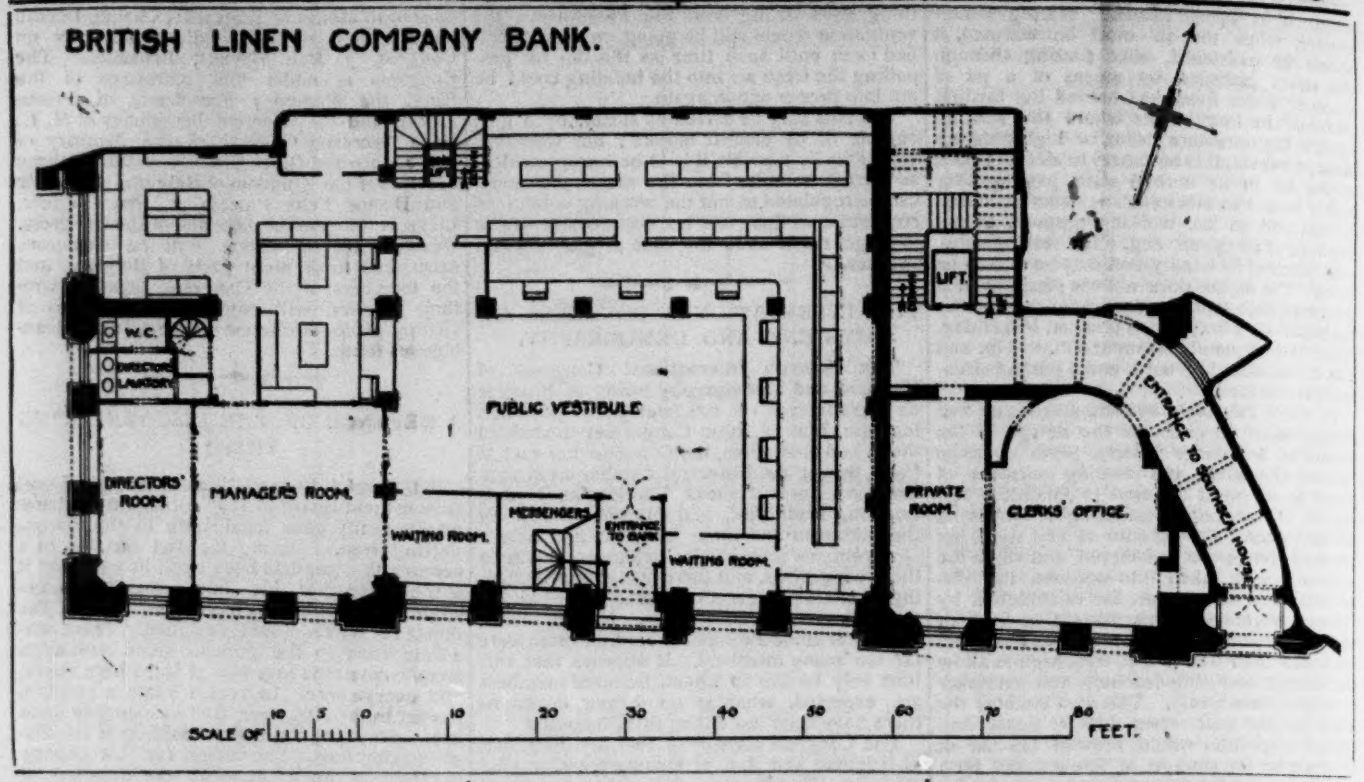
In defending the disconnecting trap we must, firstly, ascertain the necessity of disconnexion, and secondly, whether the traps in use adequately fulfil the purpose for which they are required. The object of disconnexion is to prevent sewer air obtaining access to the house-drain air, because, and this is the main point, sewer air may be laden with sewer gas and disease germs. In the modern house drain it is impossible for gas to be generated, and is it fair to the householder that the air from the sewers should circulate through his drains, and bring with it possible dangers which have been manufactured in the sewers themselves? The house drain can be made non-dangerous, can be well ventilated and thoroughly flushed; and when the householder has done this surely his duty is ended. The sewer likewise should be made perfect, and be well ventilated by the local authority, and should not be the means of communicating foul air, whether laden with disease germs or not, to each house which adds its quota to the sewer.

It must be granted that the disconnecting trap makes the ventilation of the sewers a greater necessity than if the sewer air were allowed to circulate through the house drains; but on the other hand, the municipal engineer can better regulate the air of the sewers if all householders' openings into the sewer are trapped.

If the disconnecting trap be omitted, the householder runs a greater risk from the openings in his drainage system. Every unsealed opening would give an outlet for positive sewer air and gas, whereas if a trap were in use it would only be the air from the drain itself which would be able to find an outlet at the unsealed opening. The position of the disconnecting trap is important, and should be as near the sewer as possible to avoid a stagnant length of drain between the trap and the sewer. A trap offers some impediment to the flow of the sewage, and it would be well if the by-laws enforced the provision of a manhole in conjunction with every disconnecting trap. By this means occasional blockages could readily be removed, although it is generally found that the blockage has been caused by something that ought never to have got in the drain.

The modern trap, as perfected by years of trial, fulfils its purpose well, and if properly fixed offers little impediment to the flow of the sewage. Against all the disadvantages that can be urged the householder has the satisfaction of knowing that he is in no danger

* Abstract of a paper by Mr. William Ransom, Assistant Surveyor to the Corporation of Worcester, read before the Conference of Engineers and Surveyors in connexion with the recent Congress at Bradford of the Sanitary Institute.



of inhaling dangerous sewer gases, and if the drain be properly used the disconnecting trap need never become blocked.

Illustrations.

THE BRITISH LINEN COMPANY BANK.

THE new London premises of this old-established Scottish bank have been erected in Threadneedle-street on the site of what in recent years was known as "The Baltic," but what formerly was the celebrated "South Sea House," the freehold of which was purchased by the bank.

Nearly the whole of the ground and basement floors are occupied by the bank, with the central entrance in Threadneedle-street. The three upper floors are let as offices, with a separate entrance at the east end of the front, which in deference to the past has been designated "South Sea House." The sculpture over this entrance has a history of its own. It was designed in the early part of last century by a sculptor named Bacon for the South Sea House, who refused—so is the tale—to pay him the price he asked, and rather than part with it at their valuation he put it up on the south wall of his studio in Newman-street (now occupied by Messrs. Burke & Co.), where it remained until last year. Quite casually, I one day happened to observe it, and on learning its history I purchased it, through the courtesy of Mr. Burke, for the bank, and erected it where it now is—the very spot it was designed to occupy about a hundred years since. The general contractors for the building were Messrs. Ashby & Horner, and the clerk of works was Mr. J. A. Spooner.

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THIS design, by Messrs. Thomas & Percy Worthington, was placed first in the competition recently held for the building.

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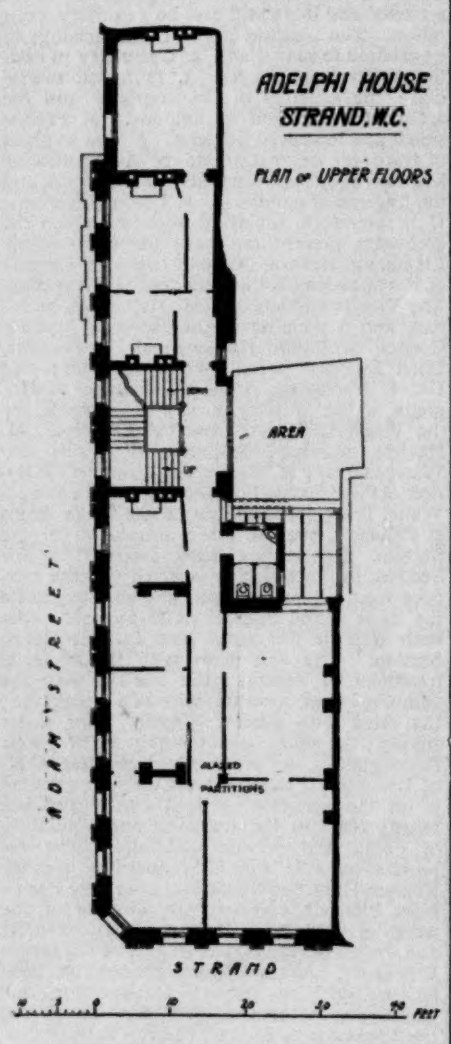
The second floor contains three pavilion wards for men, women, and children, with the necessary accessories, and the nurses have their home on the Quay-street front. The kitchens and servants are on the top floor.

The hospital, however, deals principally with outpatients who come for consultation or for systematic electrical treatment by Finsen lamp, Röntgen rays, &c., and, therefore, the main part of the ground floor is appropriated to outpatients, and contains waiting hall for two hundred persons, with attached consultation and examination rooms, special baths, dispensary, &c., and on the first floor is the department for electrical treatment, and large rooms for Finsen lamp and Röntgen rays, together with necessary accessory rooms and sanitary arrangements.

The basement, which forms a ground floor opening into a central court approached through a sloping cartway from Quay-street, contains stores, laundry, heating apparatus, &c. and is connected to each floor by lift and direct service stair running from top to bottom of building. The building is designed to be carried out in brick and stone.



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The leading types of by-product coke-ovens and the various forms of gas-producer have been frequently described and discussed before the engineering and technical societies. The large gas-engine and the economic possibilities of its use with blast-furnace and producer-gas have also been fully brought under the notice of engineers and manufacturers, who are now awaiting with interest the results of large installations which have been started, or are in course of erection. If these installations in any degree justify the estimates and expectations of their performance, and if it is shown that electricity can be produced in bulk at a cost of 0·1d. to 0·2d. per kilowatt-hour, with a capital expenditure for gas-producers, gas-engines, and dynamos, of 16*l.* to 18*l.* per kilowatt, even the least sanguine among us must realise that a new era in fuel-consumption has set in.

Not only are power-gas and the large gas-engine on their trial, but the replacement of coal-firing by gas-firing is in the same position. From results which are in my possession it seems not improbable that the economical firing of steam-boilers with washed gas will be firmly established during the present year. The use of washed gas in iron and steel making is also receiving the most careful attention, and the results of large installations for this purpose will soon be available. The amount of coal which is involved in these departments of consumption is between

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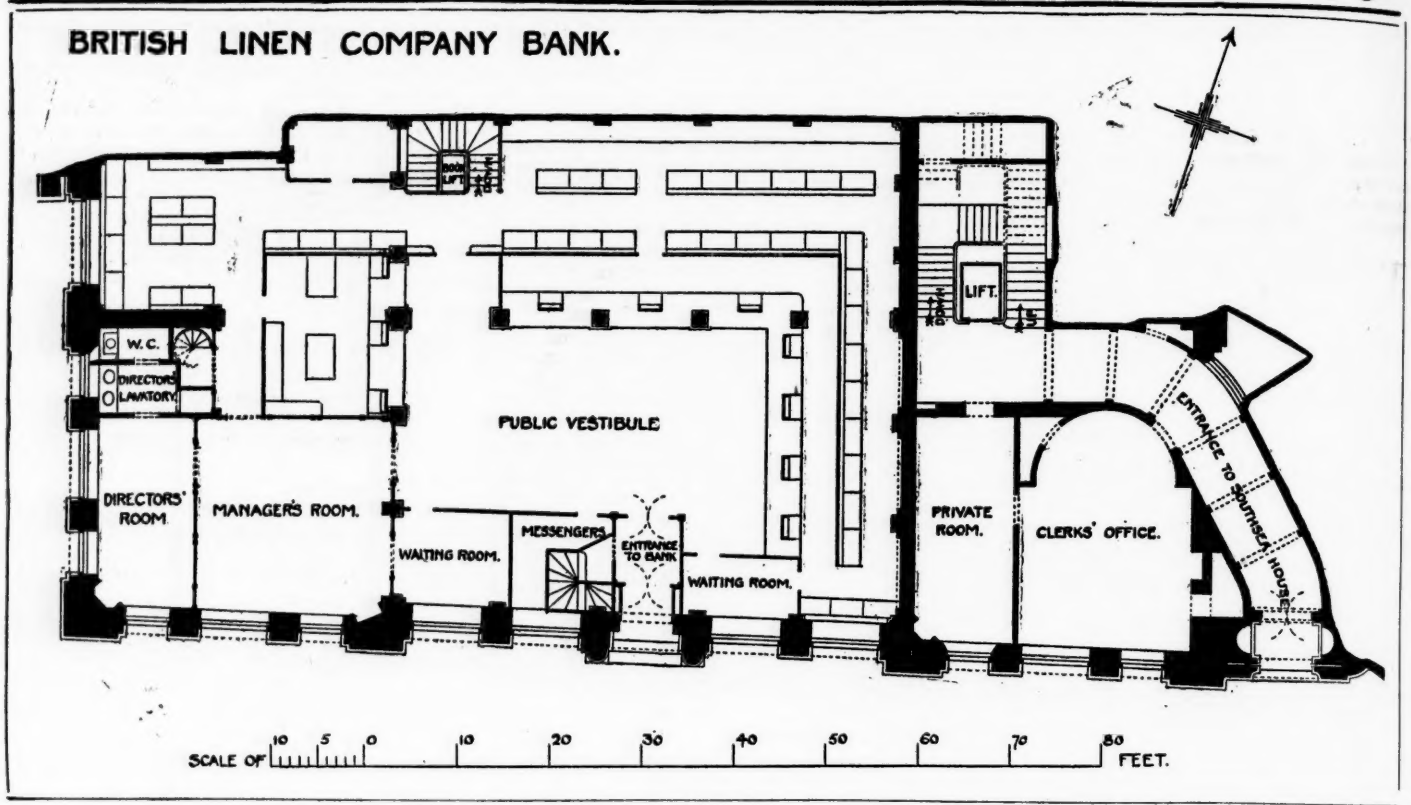
PHOTO-LITHO. SPRAGUE & C° LT° 4 & 5 EAST HARDING STREET FETTER LANE E.C.

F.R.I.B.A., ARCHITECT.



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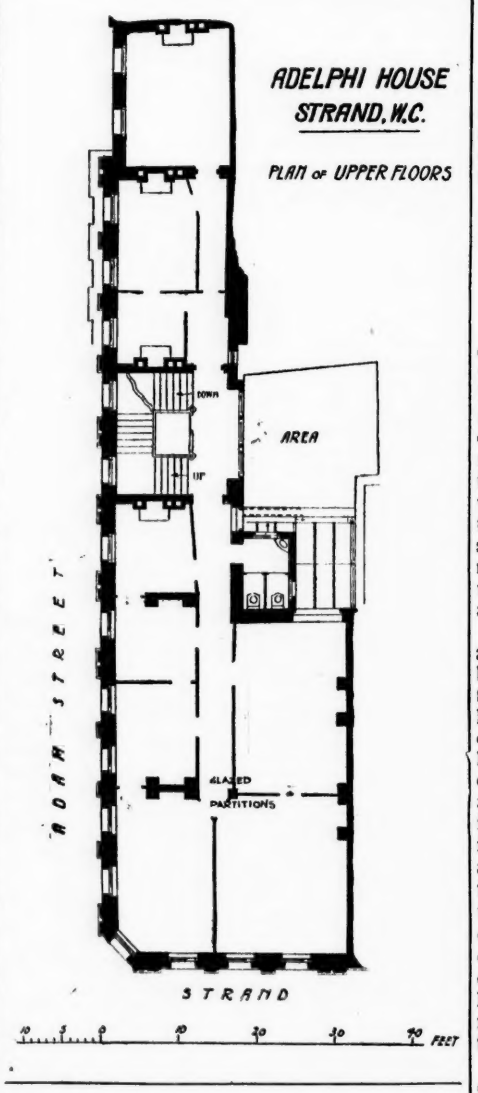

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80 million and 100 million tons per annum, and it is estimated that one-third of this may be saved if the new departures are even moderately successful. When it is added that these new developments, without exception, involve the absolutely smokeless consumption of coal, it becomes evident that the time is near when the nation, if it chooses, may abolish industrial smoke. These new developments have raised a number of interesting and important questions, the adequate discussion of which would occupy not one sitting of the Congress, but many. It is evident, therefore, that the present discussion must be mainly confined to the central question: What steps can be taken to hasten the abolition of the smoke nuisance? The answer to this as regards industry has practically been given above. The means for bringing about the revolution are already in the hands of the engineer, and it will be for him to show to the users of power and heat how substantial is the prize which awaits the enterprising manufacturer.

The problem of domestic smoke is in a less hopeful position. The consumption of coal in domestic fires is about 36 million tons per annum. This huge consumption is so completely spread over the whole nation that it may safely be said that there is not one individual in the population of 40 millions who is not directly interested in it. It is this fact which makes the domestic problem in many respects harder to solve than the industrial. To the manufacturer we can hold out as an inducement to make an end of his smoke the hope of a handsome premium in the shape of savings on his bill for fuel and power; but for the householder there is no such premium. True, the saving in the cost of cleaning and redecorating the house and the reduction in the laundry bill would represent no small amount for the average family, but at present the means whereby these desirable savings may be effected are somewhat vague and uncertain, and are supposed to involve a serious initial outlay. If the direct inducement for the householder to abolish his smoke is insufficient to overcome his inertia and conservatism, it is clear that pressure must in some way be applied from outside. The following are three ways in which this might be done—by a great and permanent rise in the price of coal; by prosecution and fining; and by the imposition of a tax on the burning of smoke-producing fuels. As to the first, there is no likelihood that the price of coal will rise to a point which would compel the householder radically to alter the whole practice of domestic heating; it may, therefore, be dismissed without consideration. For the second method, that of legal conviction, there is little that is favourable to be said. One effect of the extension of this method from the industrial to the domestic department would be to direct increasing attention to all sorts of patent grates and other nostrums, and to divert it from the broad fundamental proposition, namely, *that bituminous coal cannot be uniformly and systematically burned in open fires without smoke.* I am well aware that there are good grates as well as bad, and that wonderful efficiency and economy can be secured by the skilful designing and setting of domestic grates; but there are two permanent conditions which make it improbable that any large measure of success will be obtained in this direction. These are the irregularity in the quality of the coal consumed and the dependence of the performance of any grate on the skill and judgment of the person who fires it. The domestic grate is at the mercy of a larger and more varied selection of incompetent stokers than any other coal-consuming appliance!

We are driven, therefore, to the third means of applying the necessary pressure, namely, the imposition of a tax on the consumption of smoke-producing fuels. I venture to suggest that a chimney-tax might be so applied as to stimulate and encourage the widest and most radical improvement in domestic heating. Tax every chimney which is sufficiently wide to vent the products from the burning of raw coal, and leave free all those which are too small to do this. This would at once place a premium on the use of smokeless fuel, as gas and coke can be satisfactorily burnt with very narrow chimneys. The production of these forms of fuel would be enormously stimulated, and the devising of appliances for their combustion would be encouraged. The architect and the engineer would have a new and fruitful field for their ingenuity and skill, and their trained efforts would in a short time greatly advance our practical knowledge of the subject.

At present the 9-in. chimney holds absolute sway, and a house built without its full complement of these chimneys is looked on as abnormal and outside of the ordinary practice of those who buy and sell or who lend money on house property. The builder, therefore, declines to build houses which are really adapted for smokeless firing by gas or coke, with the result that these fuels have never had a chance of showing at their best. If there is a really serious intention of dealing with the question of domestic smoke, I believe it must be somewhat on the lines here indicated.

Appendix.—Coal Output and Consumption.

Taking the coal output of the United Kingdom at the round figure of 220 million tons, and the exports as 60 million tons, there remains for home consumption 160 million tons; of this it is estimated that:—

About 78 million tons is consumed for the production of power for industrial purposes.

About 46 million tons is consumed for the production of heat for industrial purposes.

About 36 million tons is consumed for the production of heat for domestic purposes.

Taking the first two items more in detail, it is estimated that for the production of power:—

Railways consume	12 to 14	millions.
Coasting steamers	6 „ 8	„
Factories	40 „ 45	„
Mines	10 „ 12	„

For the production of heat for industrial purposes:—

Blast furnaces consume	16 to 18	millions.
Steel and iron works	10 „ 12	„
Other metals	1 „ 2	„
Chemical, glass, potteries, and cement	4 „ 6	„
Gasworks	14 „ 15	„

Thirty-six million tons of coal is burned in about eight million inhabited houses.

At the rate of two working chimneys per house a tax of 1s. per chimney would yield 800,000*l.*

TRADE CATALOGUES.

WE have received from the General Electric Company of Queen Victoria-street, copies of their newly-published lists, comprising "Witton" continuous current motors (P. 1,023), July Progress Sheet (No. 1,035), and the "Little Geeko" telephone (K. 1,036). In 1902 the General Electric Company opened new works at Witton, where they have devoted much attention to standardising their well-known "Witton" Motors. These motors are now obtainable to suit all classes of users, the range in size and voltage being considerable. Great care is taken in the construction of the commutator, the insulation being of specially prepared mica. The different parts are all lettered, and, being interchangeable, they can be replaced readily and cheaply. The "Little Geeko" Telephone is the result of an attempt on the part of the General Electric Co. to compete with the influx of cheap foreign telephones. It is of extremely simple construction, well made, and neat, and is designed to be readily attached to existing electric bell systems. The progress sheet contains particulars of some of their latest designs in fittings (fixtures) for the electric light. The "Utility" lamp-holder can be used for many different purposes. It can easily be fitted for a reading lamp on a table or desk, or for a piano. In the August "Progress Leaflet," we notice that reductions have been made in the prices of main-switches and cut-outs for electric wiring. The Company also list some novel accessories for tramway working. The "Acme" patent splicing sleeve is a very simple and efficient invention, by means of which a thoroughly good joint in a trolly wire can be made in a few minutes. It will be appreciated by tramway engineers.

The Pearson Fire Alarm Co., of King William-street, have sent us a prospectus of their automatic fire-alarm system. They place several fusible metal strips, or thermostats, at various points of the building to be protected. These are connected electrically to a recording board at a Pearson central office, or sometimes, when permission is obtained, directly to the offices of the fire brigade. When any of the fusible strips melt an automatic signal is received at the central office, which is generally very close to a fire-station, and so the brigade is at once notified. The company's inspectors pay regular visits to all installations under their charge, and make private tests of efficiency.

Mr. Percy Pitman, of Ledbury, sends us his new lists of Pelton water wheel motors, suitable for any pressure or fall of water. High pressure wheels are made to work from hydraulic power mains, and low pressure wheels suitable for use with water from ordinary supply mains. In these wheels the water issuing from a round nozzle strikes the centre bifurcation and is deflected equally to both sides, thus acting entirely by impulse.

Messrs. George Howson & Sons, Ltd., of Eastwood Sanitary Works, Hanley, send us their catalogue of fireclay and earthenware sanitary fittings and accessories. The catalogue contains about 200 pages, and is printed on good paper and fully illustrated by means of process blocks. The fittings include lavatories, baths, water-closets, urinals, and sinks. Enamelled fireclay appears to be the specialty of the firm, a large variety of lavatories, sinks, and urinals in this ware being shown, and also a number of baths. Particular mention may be made of the stall urinals. Some of the waste and overflow fittings for the baths, lavatories, and sinks are of good types, but the seventeen pages devoted to cast-iron lavatory stands contain some very ugly specimens of the founder's "art." Complete prices are given, and the catalogue is certain to prove useful to architects and builders.

Correspondence.

THE ST. LOUIS EXHIBITION AND AMERICAN ARTISTS RESIDING ABROAD.

SIR,—Professor Halsey C. Ives, Chief of the Art Department of the International Exhibition to be held in St. Louis next year, has appointed Messrs. James McNeill Whistler, Chairman; Edwin A. Abbey, J. McLure Hamilton, and John S. Sargent, with Mr. Joseph Pennell as Honorary Secretary, to act as a Committee of Selection for the United Kingdom, and as a jury to decide upon the works submitted to them by American artists living and working in this country.

By the regretted death of Mr. Whistler the Committee is deprived of an invaluable member, whose advice and assistance had been most useful in the earlier stages of their work.

American artists residing in the United Kingdom are therefore informed that a regulation has been adopted by the Art Authorities of the Exhibition to the effect that "American artists residing in a foreign country will be admitted only as exhibitors in the United States Section."

Further information will be supplied upon application to the Honorary Secretary, at 14, Buckingham-street, Strand, W.C.

GEORGE F. PARKER, Commissioner.

Sanctuary House, Westminster.

A CROYDON APPOINTMENT.

SIR,—In your issue for August 15, an advertisement appeared from the County Borough of Croydon for the appointment of a Borough Engineer and Surveyor.

After stating that applicants must be members of the "Institute" of Civil Engineers, experienced municipal engineers and surveyors, and have had experience in sewage disposal works, Parliamentary work, water works engineering, and control of highways, and that preference will be given to one with knowledge of electrical tramways, the advertisement winds up by stating that the gentleman appointed would also be required to act as architect and valuer of the Council.

Now, I consider that the representative architectural body should make a protest in this case, and in any case where a public body requires an engineer and surveyor to encroach upon an architect's duties.

Surely Borough Engineers and Surveyors have quite enough to do to carry on their own work properly without taking on architecture as well.

August 17, 1903. SILEX.

"TACKY" PAINT.

SIR,—It is not difficult to account for the trouble which "Tar Brush" (see your issue for August 8) has with his paint. In every probability it arises from the use of too much driers. This is an error very commonly made. A painter puts into a mixing of oil paint "plenty of driers" in the belief that he is ensuring an increased hardness of finish, while

as a matter of fact, he is actually courting the very disaster described by your correspondent.

Linseed oil, of course, dries or hardens by absorbing oxygen from the atmosphere. Driers contain a surplus of oxygen and so bring about a quickening of oxidation. But if the process be hastened beyond a natural limit, the result is a hardening of the oil on the surface only, leaving the paint beneath soft. The deceptive hardening after a few weeks becomes softened by the soft oil underneath it, and hence we hear of "tacky paint."

If "Tar Brush" will take care not to use more than 2 oz. of driers to the pound of linseed oil, or 1 oz. when the base of the paint is white lead, and if he will allow plenty of time for the work to dry, he will not be further troubled with tacky paint. If quick drying is absolutely necessary, he should—excepting in the priming coat, use no oil at all but only gold size and turps. The paint will then soon dry hard and flat, and can be varnished as a finishing coat.

Arthur S. Jennings,
Editor of the *Decorator*.

The Student's Column.

CONCRETE-STEEL.—VIII.

THE THEORY OF BEAM DESIGN.

We have now sufficient data relative to the adherence, expansion, and proportionate elasticity of concrete and steel to enable us to form some idea of the principles governing concrete-steel design. Although published records afford evidence of the fact that concrete acquires greatly increased strength when combined with steel, a very usual practice is to allow nothing for the value of the concrete in the tension area of a beam, so far as concerns resistance to flexure. It is known that the concrete is in tension, and as the value of every element in a structure should be determined and properly taken into account, this method of dealing with concrete below the neutral axis is not satisfactory from the theoretical standpoint.

A correct theory of concrete-steel should offer a rational explanation of the relative work done by each material, and it should provide for utilisation of the augmented strength of the concrete up to the maximum permissible limit. Similarly it should take into account the increased compressive strength of reinforced concrete above the neutral axis. At the present time knowledge is inadequate for the establishment of a theory to which no objection might be taken, and many engineers prefer to wait for confirmation of the remarkable results that have been arrived at within recent years before setting aside rules that have been found satisfactory and safe in actual practice.

If the value of the concrete in tension be omitted from calculation, the proportions adopted may certainly be much poorer than would otherwise be desirable for the lower portion of the beam; but, on the other hand, the concrete in the upper portion should be of superior quality, for the purpose of affording high resistance to compression.

In the case of a steel beam, where resistance to tension and compression is of equal value, the neutral axis must pass through the centre of gravity of the section. This is not necessarily so in a beam of simple concrete, for the position of the neutral axis may be affected by the fact that the compressive strength of the material is ten times greater than its tensile strength. The usual assumption that the cross section of a beam remains plane after bending is only approximately true, and variations in the proportionality of stress and strain affect the form of stress diagrams, so that instead of being bounded by straight lines, the figures representing stresses are of more or less curved outline. As stress increases, the neutral axis may move away from the axis through the centre of gravity of the section, and if the law of variation of stress and strain were known, there would be tangible data for the exact computation of the actual stresses at the outside fibres of beams. The ordinary rule, $f = \frac{3}{4} \cdot Wl \div bd^2$, does not attempt to differentiate between stress at the upper and lower fibres, and the results obtained are only true upon the assumption that the neutral axis passes through the centre of gravity of the section. Therefore, for materials in which the relations of stress and strain vary under tension and compression, it gives values that are too high for one kind of stress and too low for the other. When dealing with beams of concrete-steel, where, in addition to differences in the resistance of concrete to tension and compression, we have to consider the effects due to the quantity and disposition of the steel, the formula is of no assistance.

Consequently, some alternative method of calculation becomes essential, and for the purpose of providing a basis for the establishment of some simple rules, we will inquire what is the probable position of the neutral axis in a beam, where compressive stress is not limited by the low tensile resistance of the material.

Let x and y represent the distances of the top and bottom surfaces from the neutral axis, and d the total depth of the beam, the axes of compression and tension passing through the centres of gravity of the upper and lower stress areas, that is, two-thirds of the distance between the neutral axis and the extreme fibres.

Then the resistance of the compression area will be $10x \times 0{\cdot}66\dot{6}x = 6{\cdot}6\dot{6}x^2$; and the resistance of the tension area will be $y \times 0{\cdot}66\dot{6}\,y = 0{\cdot}66\dot{6}y^2$. If these are equal, $6{\cdot}6\dot{6}x^2 = 0{\cdot}66\dot{6}y^2$, or $10x^2 = y^2$. But as $x + y = d$, it follows that $x + x\sqrt{10} = d$. Hence $x = d \div (3{\cdot}16 + 1) = d \div 4{\cdot}16$, and $y = d - (d \div 4{\cdot}16)$.

Thus the proportionate depths of x and y should be $0{\cdot}24\,d$ and $0{\cdot}76\,d$ respectively.

By adding steel in the tension area to such an extent that the resistance of steel + concrete is ten times greater than the resistance of concrete in the compression area, we have the result $x^2 = 10y^2$, and the proportionate depths of x and y should be $0{\cdot}76\,d$ and $0{\cdot}24\,d$.

In one case the neutral axis is near the top of the beam, and in the other near the bottom. Between these extremes any required variation may be effected by adjusting the relative resistance of the materials in the compression and tension areas, and the inference is that the position of the neutral axis in a concrete-steel beam depends largely upon the proportions of concrete and steel, and upon the disposition of the steel with respect to the neutral axis.

From the foregoing it is clear the height of the neutral axis may be calculated for any beam after these details have been settled, or that the proportions of concrete and steel may be adapted to any chosen position for the neutral axis.

Bending moment developed in any beam must always be resisted and held in equilibrium by the moment of resistance of the section. Therefore, in every case the bending moment must be equal to the moment of resistance; or $M = R$.

For a uniformly distributed load on a beam of the length l, supported at each end, $M = Wl \div 8$, and from the general expression for the moment of resistance, $R = f\ I \div h$, we get

$$R = f.bh.\tfrac{2}{3}h$$

where f = unit fibre stress at the distance h from the neutral axis; b = breadth of the section; and h = distance of the extreme fibres from the neutral axis.

As $M = R$, the following rules are deducible from the equation:—

$$\frac{Wl}{8} \times \frac{1}{fbh.\frac{2}{3}h} = 0.$$

Whence

$$f = \frac{Wl}{5{\cdot}3bh^2}, \text{ and } W = \frac{5{\cdot}3f.bh^2}{l}.$$

As the total stress has to be calculated per square inch on the steel, and not for the whole tension area, the quantity $bh = 1$.

Consequently we have for the steel reinforcement

$$f = \frac{Wl}{5{\cdot}3h}, \text{ and } W = \frac{5{\cdot}3fh}{l}.$$

The following examples will serve to illustrate the manner in which these rules may be used for proportioning beams to suit any given conditions of loading and span. We have in each case taken a uniformly distributed load, but loads of different character can easily be dealt with by variation of the rules in accordance with the expression indicating the value of the corresponding bending moment.

The average fibre stresses assumed are:—15,000 lbs. per square inch for steel; 500 lbs. per square inch for concrete in compression; and 50 lbs. per square inch for concrete in tension.

Each example refers to the case of a beam 12 in. deep, with a clear span of 100 in. between the supports, and carrying a uniformly distributed load of 4,000 lbs., which includes the weight of the beam itself. The object is to find the required sectional areas of steel and concrete.

Example 1.—In the first place, we will assume the neutral axis at 7 in. above the bottom of the beam. The various measurements of height will, therefore, be in the proportions indicated in fig. 13, the height of the steel

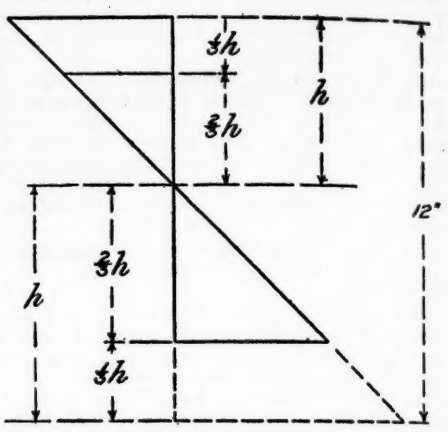

FIG. 13

above the bottom of the beam being $\frac{1}{3}h$, and, as the value of the concrete is not included in this calculation, the area below the steel is shown by broken lines. The total stress per square inch of steel will be

$$f = \frac{W\,l}{5{\cdot}3\,h} = \frac{4{,}000 \times 100}{5{\cdot}3 \times 7} = 10{,}714{\cdot}28 \text{ lbs.}$$

The stress per square inch of steel being limited to 15 000 lbs., the requisite area is $10{,}714{\cdot}25 \div 15{,}000 = 0{\cdot}71$ sq. in.

The width of concrete section in the compression area can be found by a modification of the formula $f = \frac{Wl}{5{\cdot}3\,bh^2}$.

Thus:

$$b = \frac{Wl}{5{\cdot}3fh^2} = \frac{4{\cdot}000 \times 100}{5{\cdot}3 \times 500 \times 5^2} = 6 \text{ in.}$$

The dimensions of the beam will consequently be 12 in. deep by 6 in. wide = 72 sq. in., and the steel may be divided into two or more bars placed along the axis of tension, 4.6 in. below the neutral axis.

To prove the accuracy of these proportions, the resistance of each area may be calculated by the equation—

$$R = f \cdot bh \cdot \tfrac{2}{3}h.$$

For the steel—

$$R = 10{,}714{\cdot}28 \times 1 \times (\tfrac{2}{3} \times 7) = 50{,}000 \text{ inch pounds.}$$

For concrete—

$$R = 500 \times (6 \times 5) \times (\tfrac{2}{3} \times 5) = 50{,}000 \text{ inch pounds.}$$

Therefore the moments of the internal forces are in equilibrium, and as $M = 400{,}000 \div 8 = 50{,}000$ inch lbs., the condition $M = R$ is satisfied.

We will now see what alterations might be made on account of the resistance possessed by the concrete in tension.

The dimensions of the compression area may remain the same as already found, because the resistance of concrete + steel is exactly the same as the resistance furnished by the sectional area of steel.

Calculating the proportion of the load carried by the concrete for a stress of 50 lbs. per square inch, we have

$$W = \frac{5{\cdot}3\,f\,b\,h^2}{l} = \frac{78{,}400}{100} = 784 \text{ lbs.}$$

Consequently the stress to be carried by the steel is 8,614·25 lbs., and the area becomes 0·57 sq. in., the reduction representing a saving of about 10 per cent.

Example 2.—In the next place, while assuming the neutral axis at 7 in. above the bottom of the beam, we will fix the axis of tension for the steel at 2 in. from the bottom. The rule $f = \frac{W\,l}{5{\cdot}3\,h}$ will not apply to this case, and it must be modified in the manner following:—

$$f = \frac{W\,l}{8\,(h - x)}.$$

Here x is the distance between the centre of the reinforcement and the bottom of the beam.

The total stress per square inch of steel is now

$$f = \frac{4{,}000 \times 100}{8\,(7-2)} = 10{,}000 \text{ lbs.}$$

Consequently, the required sectional area is 10,000 ÷ 15,000 = 0·66 sq. in., while the cross-section of the concrete remains 72 sq. in. Economy is, therefore, seen to be secured by increasing the leverage of internal force in the tension area.

Allowing for the resistance of concrete in the tension area as before, the net area of steel becomes 0·53 sq. in.

Example 3. — Further economy would be attained if the neutral axis were 1 in. higher, that is, 8 in. above the bottom of the beam. Keeping the reinforcement at 2 in. from the bottom, we have for steel in tension

$$f = \frac{4{,}000 \times 100}{8\,(8-2)} = 8{,}333 \text{ lbs.}$$

This is equal to a sectional area of 8,333 ÷ 15,000 = 0·55 sq. in. For concrete in compression the required width is

$$b = \frac{W\,l}{5{\cdot}3\,f\,h^2} = \frac{4{,}000 \times 100}{5{\cdot}3 \times 500 \times 4^2} = 9{\cdot}375 \text{ in.}$$

Therefore, the compression area measures 4 × 9·375 = 37·5 sq. in., but the tension area need not be wider than 4·3 in., giving a section of 4·3 × 8 = 34·4 sq. in., and making a total area of concrete for the beam of, say, 72 sq. in. These dimensions would give a T-shape to the beam, and if incorporated in a floor, the wide flanges would practically cost nothing, as they would form part of the floor panelling.

Allowing for the resistance of 34·4 sq. in. of concrete in the tension area, the net area of steel becomes 0·44 sq. in.

Example 4.—If preferred, a uniform width of 6 in. can be given to the beam by incorporating steel bars in the compression area.

Keeping the neutral axis, as in the previous example, at 8 in. above the bottom of the beam, the sectional area of steel in tension will again be 0·55 sq. in., or allowing for the assistance furnished by the concrete, the area will be reduced to 0·41 sq. in.

The total stress in the compression area is

$$f = \frac{4{,}000 \times 100}{5{\cdot}3h} = \frac{400{,}000}{5{\cdot}3 \times 4} = 18{,}750 \text{ lbs.}$$

of which the concrete takes 12,000 lbs., leaving 6,750 lbs. for the steel. Consequently, the sectional area of the latter must be 6,750 ÷ 15,000 = 0·45 sq. in.

Before summarising and comparing the chief results afforded by the foregoing examples, we will calculate the proportions of a beam made of simple concrete. The load and span are to be the same as those in previous examples. The strength of the beam is necessarily limited by the tensile resistance of the material, and although concrete in compression may be capable of withstanding a stress of 500 lbs. per square inch, we cannot allow more than 50 lbs. per square inch to be developed in the compression area. This condition evidently agrees with the assumption of a central position for the neutral axis.

Example 5.—In the first place, we will calculate the stress for the dimensions, 12 in. deep by 6 in. wide.

For the conditions stated we find the stress to be

$$f = \frac{4{,}000 \times 100}{5{\cdot}3 \times 6 \times 6^2} = 347{\cdot}2 \text{ lbs. per square inch.}$$

(*a*).—As this is much beyond our limit, we must ascertain the dimensions necessary for complying with the unit stress of 50 lbs. Keeping to the depth of 12 in., we get

$$b = \frac{W\,l}{5{\cdot}3\,f\,h^2} = \frac{4{,}000 \times 100}{5{\cdot}3 \times 50 \times 6^2} = 41{\cdot}66 \text{ in.}$$

(*b*).—But we may make the beam deeper with great advantage. If a section be adopted in which the depth = 2*h*, we have for one-half of the total area

$$bh^2 = b^3 = \frac{4{,}000 \times 100}{5{\cdot}3 \times 50} = 1{,}500 \text{ sq. in.}$$

and as $b = \sqrt[3]{1500} = 11{\cdot}447$ in., the final dimensions of the beam are $b = 11{\cdot}447$ in., and $d = 22\,894$ in., practically 12 in. wide by 24 in. deep.

(*c*).—If a square section be preferred, we obtain

$$2\,(bh^2) = b_1{}^3 = \frac{4.000 \times 100}{(5\,3 \times 50) \div 4} = 6{,}000 \text{ sq. in.}$$

and $b_1 = \sqrt[3]{6000} = 18{\cdot}171$ in., and the section is practically 18 in. square.

The above calculations may be verified by using the ordinary formulas, which, in this instance, are perfectly suitable.

Table XXI. is a summary of the results obtained in the foregoing calculations, and it will be observed that considerable advantage follows the higher position of the neutral axis and

Table XXI.—Concrete-Steel Beams Compared with a Simple Concrete Beam.
(Load, 4,000 lbs. Span, 100 in.)

Material.	Dimensions. *b*	Dimensions. *d*	Height of Neutral Axis.	Height of Steel Axis.	Area of Steel.
Concrete-Steel.	In. 6	In. 12	In. 7	In. 2½	Sq. In. 0·71
,,	6	12	7	2	0·66
,,	9·37* / 4·31†	12	8	2	0·55
,,	6	12	8	2	0·55† / 0·45*
Simple Concrete.	41·6	12	—	—	—
	12	24	—	—	—
	18	18	—	—	—

* Compression † Tension.

the lower position of the steel reinforcement. It is further noticeable that much less advantage is derived from the incorporation of steel in the compression area than in the tension area. This is quite natural, because the steel in tension has the effect of utilising an excess of compressive strength in the concrete that would otherwise be wasted, whereas steel in compression merely counterbalances the strength of steel added in the tension area. Nevertheless, the employment of steel in this manner is very frequently necessary, and it enables the designer to carry out work that would otherwise be impracticable. The saving to be effected by allowing for the strength of concrete in tension is small, but the influence of the strength so contributed ought always to be taken into account, whether any reduction in the area of steel be made or not.

OBITUARY.

MR. WM. WILKINSON.—The death took place on Sunday, the 16th, at 31, Port-street, Southport, aged seventy-five, of Mr. William Wilkinson, who was for many years President of the Southport Master Builders' Association. He was a native of Tealby, Lincolnshire, and came to Southport forty years ago. He built the Mornington-road Wesleyan Church, the Chapel-street Congregational Church, and many other structures in the town and district.

GENERAL BUILDING NEWS.

CHURCH, BALLYMAHON, IRELAND.—The foundation-stone of the new Church of St. Matthew has just been laid at Ballymahon. The new church will be Gothic in style and will consist of a nave, transepts, sanctuary, and choir. The nave will be nearly 90 ft. in length, with a width of 30 ft., and the transepts are 77 ft. across and nearly 27 ft. wide. At the front elevation of the new church, and facing to the west, is a tower, rising to the height of 120 ft. Provision is made for a pitch pine organ gallery and a nuns' choir. The chancel arch will consist of Irish granite; the walls are to be of lime stone, provided from the local quarries of Mount Cashel, Ross, and Tullamore. The plans were prepared by Mr. T. F. M'Namara, and the builder is Mr. Patrick Kelly, Longford.

CHURCH ROOM, ST. GEORGE'S CHURCH, LLANDUDNO.—The new church room in connexion with St. George's Church, Llandudno, erected in memory of Dr. B. Williams, J.P., Morannedd, was dedicated recently by the Venerable Archdeacon Morgan, M.A. The new room, which has been added to the north side of the church, is connected by means of a passage with the chancel, and has been built in harmony with the design of the church. The building has been erected by Mr. Thomas Jones from the designs of Mr. Edwin Turner, under whose supervision the work has been carried out. The chancel has been refitted with oak stalls and a clergy desk. These have also been executed by Mr. Jones from the designs of the architect.

PUBLIC SCHOOL, FAULDHOUSE, LINLITHGOW.—The School Board for the parish of Whitburn have recently erected a new school at Fauldhouse. The new school has been placed in the front of the present playground, and contains twelve class-rooms two halls (lower and upper), and will have accommodation for 634 scholars, made up as follows:—Boys, 208; girls and infants, 426. The architect is Mr. J. Graham Fairley, Edinburgh, and the contractors are Messrs. Wilson & Wallace, West Calder, and Messrs. Wm. Fairley & Son, joiners, West Calder.

CO-OPERATIVE STORES, RUSHDEN.—New drapery stores and co-operative hall have been erected on the east side of High-street, Rushden, by the Co-operative Society. The building has been erected from plans prepared by Messrs. Cooper & Williams, Kettering and Rushden. Mr. C. E. Bayes, of Rushden, was the contractor, Messrs. Whittington & Tomlin did the carpenter and joiners' work, and Mr. George Fountain was entrusted with the plumbing. The ironwork was supplied by Mr. H. T. Billson, of Kettering, and Mr. J. E. Smith, of Higham Ferrers, fitted the heating apparatus.

CHURCH OF ST. JOHN, SOUTHALL GREEN.—The vicar and churchwardens of this church (erected in 1836, with accommodation for 360 persons) have obtained from the Consistory Court of London a faculty to authorise an enlargement of the fabric upon a portion of the churchyard. The proposed enlargement will constitute in effect a rebuilding of the church on the existing site and the western portion of the burial ground, for a congregation of 800, but without any interference with the services during the work. The estimated cost of the new structure is 8,000*l.*, and that of the fittings and re-interment of the disturbed human remains is 2,000*l.*

THE NATIONAL MEMORIAL TO QUEEN VICTORIA.—The work of preparing the site for the National Memorial to Queen Victoria is now actively proceeding, and Messrs. Mowlem & Co., the contractors, have undertaken to complete it by the end of November. In the original architectural design, as prepared by Mr. Aston Webb, it was proposed to make external carriage roads round Mr. Brock's memorial, but in order that the necessary encroachment upon St. James's Park may be curtailed as much as possible, these avenues have now been abandoned, and it has been decided that all kinds of traffic shall pass, as at present, in front of Buckingham Palace. A concrete retaining wall is being built across the end of the lake, absorbing only a small portion of the water area.

BUSINESS PREMISES, HULL.—Messrs. B. L. Wells & Son, auctioneers, have just removed into new premises in Manor-street, Hull. The buildings, which have been erected from the designs of Messrs. Brodrick, Lowther, & Walker, architects, Hull and Bridlington, are English Renaissance in style. The contractors were Messrs. G. Jackson & Son, Witham, Hull.

CHURCH HALL, HASWELL.—On Saturday last the foundation stone of the church hall about to be erected at Haswell was laid by Colonel Rowland Burdon, of Castle Eden. The building is to consist of a hall 55 ft. by 27 ft., with committee and retiring rooms, also rooms for the caretaker in connexion with the adjacent parish church, the new building being built on the vacant land at the east end of the church. It is to be built of brick with stone dressings; the roof over the hall will have curved timber trusses with boarded barrel ceiling. Mr. R. Wade, of High Moorsley, Hetton-le-Hole, is the contractor, who will erect the building from the design prepared by Mr. George Fox, London, W.C.

BOARD SCHOOL, HALIFAX.—A new Board School, erected by the Halifax School Board in Battinson-road, at a cost, including the site and furnishing, of 29,500*l.*, was opened on the 17th inst. The building comprises a mixed department and an infants' department, and provides accommodation for 1,000 children. The heating and ventilation are on the Plenum system. Associated with it are a cooking-kitchen, manual instruction room, and a swimming-bath, 41 ft. by 21 ft. The architects were Messrs. C. F. L. Horsfall & Son.

CO-OPERATIVE SOCIETY STORES, BATLEY, YORKSHIRE.—A new branch of the local co-operative society, situated in New-street, Batley, was opened recently. The architect for the work was Mr. S. B. Buckley.

EXTENSION OF BLAIRS COLLEGE, ABERDEEN.—The building work in connexion with the additions to Blairs College has now been completed, and when all the internal arrangements have been attended to the place will be opened. The new buildings complete three sides of a square, being connected at the south-west end with the old establishment. The extensions have been carried out at a cost of over 33,000*l.*, from the designs of Mr. R. G. Wilson, architect, of Aberdeen. A feature of the new building is the high square tower on the north front, surmounted by four turrets. It is beneath this tower that the main entrance is placed. Above the Roman arched doorway are three panels, on which representative coats-of-arms have been carved. In the keystone of the arch of the portico are the arms of the late Pope, Leo XIII. On the right hand side of these are the arms of Mr. Menzies of Pitfodels, the donor of the estate of Blairs, on which the college is erected; and on the left are the arms of Bishop Chisholm, as registered by the Scottish Lyon King-at-Arms. Farther up the tower is a shield with a carved representation of the Papal keys crossed, and still farther up there is a monogram of a crowned M., representing St. Ma y's College—the name of the establishment now nearing completion. The college is built of grey granite, and the builder was Mr. James King, Aberdeen. From the main entrance beneath the tower the first floor is reached by a short flight of white marble steps from the entrance hall. The doorway is of teak wood. The entrance-hall has a panelled ceiling and dado of pitch pine, with pilasters at the corners. This woodwork, as also all the carpentry work in the new buildings, has been carried out by the staff of Mr. John Henderson.

At the left hand side of the entrance hall are the reception and waiting rooms, a cloakroom for the students, and one of the entrances to the sacristy, and on the opposite side of the passage a linen room, where there is a special receptacle for the clothing of each student. A flight of steps leads to the cloister, from which access is obtained to the chapel with its altar of white Carrara marble, its carved oak stalls, its organ built by Mr. E. M. Lawton, Aberdeen, and its stained-glass windows To the right hand side of the entrance hall a lobby leads to the classrooms on the west side of the building, while to the south of the west wing is a recreation hall. By a flight of pitch pine stairs one reaches the upper floor, where is the library, with walls and ceiling of pitch pine richly carved, and gallery with balustrade, the gallery being reached by a spiral staircase at the south-west corner. A dining-room for the professors is provided. A passage connects this part of the building with what has already been in use as the professors' apartments and with the picture gallery. On the third floor, occupying the two wings to the east and west, are the students' dormitories, arranged on the modern cubicle system. A room specially set apart on the top story has been designated the infirmary. On the ground floor the principal apartment is a refectory, or dining-hall, some 80 ft. in length by 32 ft. in breadth. It lies almost due north and south, with six windows on the east side, and a similar number of lesser lights on the west. The floor is laid with ornamental red tiles. There are two entrances from the lobby, one at the north and the other at the south end. Adjoining this dining-hall are the kitchen and other culinary departments, including a scullery and store-room and pantry accommodation. A lift is also provided in this department, connecting it with the upstair floors. The dormitory accommodation for the servants of the house is also on the cubicle system. A hall above the kitchen apartments is provided with a couple of fireplaces, in addition to the hot-water circulation. A bathroom and other accommodation adjoins this apartment. The accommodation for the servants is arranged in a separate two-story block at the south-east end of the establishment, with the kitchen, scullery, servants'-hall, &c., on the ground floor and the dormitory above. Immediately over the entrance portico there is an oratory. Here an altar will be erected, and the three double windows at the north, east, and west sides will be filled with cathedral leaded glass. From the belfry in the tower the old bell of the college is to be hung. A new and complete system of heating has been carried out by Messrs. Mackenzie & Moncur, Edinburgh, on the hot-water low-pressure system. The whole of the college buildings, as well as the chapel, has been dealt with, requiring the placing of some sixty radiators and between 6,000 ft. and 7,000 ft. of piping. Two large Cornish boilers, about 10 ft. in length, have been fitted in for supplying the hot-water. In addition to the heating there is also a special hot-water circulation from a special boiler in the sunk floor of the centre block, the hot water being utilised for the purpose of supplying the baths of the college. The old study-hall of the institution is to be utilised as a power-house for the generation of the electric light. The electric-lighting arrangements have been placed in the hands of Claud Hamilton, Ltd., Aberdeen. They are being carried out under the supervision of Mr. P. W. Smith, manager of the Aberdeen branch of the firm. Within the new building the wires for the electric lighting have all been fitted by Mr. Botting, electrical engineer, Aberdeen. The contractors, in addition to those mentioned, were:—Messrs. James Bannochie & Sons, Aberdeen, plasterers; Mr. Edward Copland, painter; Messrs. Thom & Strachan, plumbers; and Messrs. James Bannochie & Sons, ironmongers. Mr. Copland is the contractor for the fitting-in of the leaded glass-tinted windows.—Compiled from the *Aberdeen Journal*.

KINDERGARTEN FOR THE BLIND, HARBORNE, BIRMINGHAM.—A boarding-school is in course of erection at Harborne in connexion with the General Institution for the Blind, Edgbaston. The residential school will accommodate forty children, and will cost about 17,500*l*. A site has been secured on the Court Oak-road, with a frontage to Woodville-road. The building will be of brown brick, with red brick bands and white Grinshill stone dressings, and the roof will be tiled. The main entrance faces Woodville-road, in a slightly projecting bay, with plain columns and pilasters. The Court Oak-road front will have a gable end with quoins. This part of the building will contain two dormitories, and the other two dormitories will be lighted by one wide dormer window in the centre. On the ground floor there will be three classrooms, two playrooms, four music-rooms, dining-room, kitchen, scullery, pantry, and larder, rooms for the mistresses and matron, a small dispensary, cloak-rooms, bootrooms, airing-room, and the usual offices. There will be a couple of porches leading from the playrooms to the playgrounds on the Court Oak-road side. The upper story will be divided into four dormitories, mistresses' and servants' bedrooms, linen, wardrobe and sewing rooms, bathrooms and lavatories. There will also be an isolated wing for sick children, a room for convalescents, and a nurses' room, with separate staircase and entrance. The architects are Messrs. J. A. Chatwin & Son, of Birmingham, and Messrs. Collins & Godfrey, of Tewkesbury, are the builders.

THE COSSHAM MEMORIAL HOSPITAL, KINGSWOOD, GLOUCESTERSHIRE.—By the invitation of the Lord Mayor of Bristol (Alderman Sir R. H. Symes), the first meeting of the trustees appointed by the court for the carrying out of the testamentary wishes of the late Mr. Handel Cossham, M.P. for Bristol East, was held on the 6th inst. The scheme involves an expenditure of 23,300*l*. for building and furnishing, and the remainder of the money left by the testator, 80,000*l*., is to form an endowment for the charity. The object of the latter is to erect, establish, and maintain a general hospital for the treatment and relief of sick and injured persons of both sexes. The designs and plans for the proposed hospital, by Mr. F. Bligh Bond, have already been passed by the Court of Chancery. The site is on the top of Kingswood Hill, and the building will face south and west.

WORKHOUSE, WOLVERHAMPTON. — The new workhouse at New Cross, Wednesfield, about two miles from Wolverhampton, is to be opened on September 24. A plot of land containing 50½ acres at New Cross was purchased for 11,128*l*., and Mr. Arthur Marshall, of Nottingham, was engaged to prepare plans for the new building. The contract for their erection was entrusted to Messrs. Fish & Son, of Nottingham, the tender amounting to 156,879*l*. Of the 50½ acres, six and a-half acres have been covered with buildings, which have been designed on the block principle, and will provide accommodation for 1,246 inmates, twenty nurses, and sixty other officers. The total number of buildings is thirty-one, of which the chief are the administrative section, comprising eight blocks which are connected on the ground floor by enclosed corridors, the roofs providing means of communication between the upper wards. In the centre of this collection of buildings is the residence for the master and matron, the assistant master, clerks, chaplain, and other members of the staff. There is a dining-hall capable of seating 800 people; adjoining are the kitchens, sculleries, and stores, while abutting upon the central block are three-story buildings for each sex, a nursery, and quarters for sixteen married couples. At the rear of this block is the infirmary, with space reserved for extensions, and there are provided quarters for the medical officer and nurses. Three blocks will be utilised for males and the same number for females, and contiguous are the dispensary, operating and consulting rooms, and a lying-in ward. Still further to the rear is another block designed for the use of the imbeciles, separate quarters being provided for the epileptic patients. Two hospitals for special diseases and an isolation hospital are placed still further to the rear of the main buildings. A nurse's home has been erected to accommodate forty. A laundry, workshops for blacksmiths, tailors, tinners, carpenters, mat-makers, and wood-choppers, with the labour-master's house near by, have been provided. The whole of the buildings will be lighted by electricity, which will be supplied from a power-station situated near the centre of the grounds. Two entrances have been made from the Wednesfield-road. Near the main entrance are the porter's lodge and the boardroom and offices, and adjoining the other entrance is the casual ward. As a large area of the ground will be cultivated by the paupers, there has been in connexion with this section of the work a farm building erected, together with piggeries, stables, and other outbuildings. Conduits for carrying the gas and water pipes and the electric lighting mains have been placed around all the buildings. In the infirmary pavilions the floors are waterproof, being composed of concrete and steel joists supported on steel girders. Mr. W. Smith is the clerk of the works.

FOREIGN.

AUSTRIA-HUNGARY.—Canal works are very much to the fore just now in Austria, and the water authorities of Vienna are projecting the construction of a ship canal, presumably from the Danube. They have advertised for schemes from engineers, to which large premiums are attached, and the competition is international. The plans are to be sent in by March 31, 1904.——The town authorities of Laibach are about to erect an imposing monument to the Emperor Francis Joseph, and have invited designs from Slavonic and Croatian artists.

SOUTH AFRICA.—The boom which has taken place in building, and the high prices of building materials, lend especial interest to the Interim Report of the Building Stones Commission recently issued. Not only in the great centres, such as Pretoria and Johannesburg, but in almost every settled district of the Transvaal, Natal, and Orange River Colony, building is being pushed forward at a pace which is only limited by the supplies. It is estimated that there is a market to-day for 1,500,000*l*. sterling of flooring and ceiling boards, doors and sashes, brick, stone, and structural iron-work. The Commission appointed by the High Commissioner consists of Dr. G. Corstophine and Mr. W. Anderson. Their commission applies to Cape Colony, Natal, the Transvaal, and Orange River Colony. The Interim Report furnished gives results of inspections in Cape Colony and Orange River Colony, with the quarries of Bloemfontein and the country around the Platberg at Ladybrand. They report that a good supply exists in the Stormberg district, which needs opening up in selected localities, instead of the plan hitherto pursued of taking haphazard from the surface. The stone is a species of hard freestone of a "very satisfactory texture." At East London the Commission report "an abundance of stone of superior quality," while Queen's Town yields a supply of "really good sandstone," obtainable in large blocks free of stain or flaw, and unaffected by exposure to climate. Abundance of good stone is also reported at Bloemfontein, but discrimination is necessary in selection. At Ladybrand, the Commission states, "the whole of the upper portion of the mountain consists of sandstone in massive beds. Under the sandstone are layers of shale, which weather out readily, so that huge blocks of the overlying rock break off and roll down the slope of the hill. The present quarrying at Ladybrand consists simply in breaking up these blocks. The stone around the town has been largely utilised, and the quality has been proved by, in some cases, thirty years' exposure." So far as investigations have gone, there is shown to be plenty of stone awaiting capital and judgment to put it on the market.—*Commercial Intelligence.*

UNITED STATES.—A professional dispute amongst engineers has arisen in New York as to whether it is better to use eye-bar cables or wire cables for the suspending members of a bridge. The structure in question is the proposed suspension bridge over the East River. The Mayor appointed a commission of experts to examine the points at issue, and that body has reported in favour of eye-bar cables.—— The Boston Park Commissioners have issued regulations prohibiting advertising of any kind within any park under their jurisdiction, and further that no sign, poster, or advertisement, except signs not larger than 3 ft. by 4 ft., and relating only to the selling or letting of the premises on which the sign is placed, and signs not exceeding 15 in. in width, relating to business conducted on the premises, is to be displayed on any land within the Commissioners' jurisdiction. —— The New York State School of Forestry has apparently come to an end. Dr. Fernow, who was chief, is well known as an authority on the forest timbers of the United States.——Mr. Thomas D. Evans, one of the best-known architects in Western Pennsylvania, has recently died. He designed many of the principal buildings in and about Pittsburgh, and was for some time President of the Pittsburgh Chapter of the American Institute of Architects.——The Massachusetts School of Design, which is connected with the Massachusetts Institute of Technology, has been united with the School of Drawing and Painting of the Boston Museum of Fine-Arts.

SWITZERLAND. — A large monument is to be erected in Berne by the International Postal authorities there. Designs are invited from architects and sculptors in all parts of the world, and a premium of 15,000 fr. is offered. The competition closes on September 15, which does not leave much time for the preparation of the sketches asked for.

GERMANY.—A tablet which has been placed in the English church at Homburg in memory of the late Empress Frederick was unveiled on the 16th inst. by the British Ambassador. The tablet consists of a marble slab, on which is a bas-relief of the late Empress in bronze. The sculptor was Herr Wilhelm Orthe.

MISCELLANEOUS.

PROFESSIONAL AND BUSINESS ANNOUNCEMENT.—Messrs. G. R. McKenzie & Co., Ltd., cabinet, joinery, and parquet flooring manufacturers, have removed their offices and works to larger premises at Queen's-road Station, Battersea, S.W.

METROPOLITAN DISTRICT RAILWAY.—The report which was adopted at the last half-yearly meeting held on the 6th instant, states that the works for the electrification of the line (under the superintendence of Mr. James R. Chapman, chief engineer and manager of the Underground Electric Railways of London, Ltd.) are steadily proceeding, with the employment of about 1,000 labourers, but that rapid progress cannot be made, inasmuch as most of the work can be carried out only in the night-time. The new generating-station at Lot's-road, Chelsea, is well advanced, and 40 miles—or three-fifths of the total—of ducts have been laid beneath the public roads from Chelsea to Earl's-court. The rolling stock, which is now being ordered for the entire District Railway in all its branches, will provide a carrying capacity for from 100,000,000 to 120,000,000 passengers per annum, or about twice as many as the present numbers. A service of four electrically-propelled trains is running upon the Ealing and Harrow line, and the Company's engineers contemplate the establishment of a five minutes' service from Wimbledon, Richmond, Hounslow, Harrow, and Ealing, and, by means of the new installation, of a similar increase in the number of trains on the Whitechapel and Bow line. The Company carry from 45 millions to 50 millions upon their lines during the year, nearly 11 millions of whom belong to the working classes, paying greatly reduced fares and the Directors intimate that they

may soon find it expedient to seek for statutory powers to enable them to charge a uniform fare of 2d. without distinction of employment or profession, place of booking, or time of day.

TINTERN ABBEY.—Some interesting discoveries have been made during the recent operations for the preservation of the ruins of Tintern Abbey which, on the recent sale of the Duke of Beaufort's estates, were acquired by the Crown. An elaborate system of drainage has been revealed and a staircase for the use of the lay-brethren is disclosed. The old cottage is now demolished, and its removal brings to light portions of the original gateway and some windows that had been blocked-in by the erection of the cottage.

LONDON PUBLIC MUSEUMS AND GALLERIES.—In reply to a question put in the House, the Chancellor of the Exchequer stated a few days ago that the gross sums voted in Class IV. of the Civil Service Estimates, 1902-3, for these services were (items merged in more general sub-heads and not separable excepted):—Victoria and Albert and Bethnal Green Museums, 66,994*l.*; Geological Museum, 3,558*l.*; British Museum, 128,729*l.*; Natural History Museum, 49,051*l.*; National Gallery, 18,600*l.*; National Portrait Gallery, 5,541*l.*; and the Wallace Collection, Hertford House, 9,066*l.*

THE SANITARY INSTITUTE.—Details of the thirty-sixth course of lectures and demonstrations for sanitary officers, arranged by the Sanitary Institute, have been printed. The course from September to November comprises the following lectures:—Part 1: Four lectures on Elementary Physics and Chemistry in relation to Water, Soil, Air, and Ventilation, and Meteorology. Twenty-one lectures on (*a*) Public Health Statutes; Orders, Memoranda, and Model By-laws of the Local Government Board and the By-laws in Force in the Administrative County of London; (*b*) The Practical Duties of a Sanitary Inspector, *e.g.*, Drawing up Notices as to Sanitary Defects, Drain-testing, Disinfection, Methods of Inspection, Note-taking, Reporting, and Elementary Statistics; (*c*) Municipal Hygiene or Hygiene of Communities, including Prevention and Abatement of Nuisances, Sanitary Defects in and about Buildings, and their Remedies, Water Supplies, Sanitary Appliances, Drainage, Refuse Removal and Disposal, Offensive Trades, Disinfection; (*d*) Building Construction in its Sanitary Relations, Local Physical Conditions. Measurement and drawing plans to scale. Inspections and Demonstrations are arranged in connexion with the lectures, and include visits to various premises. Part 2 comprises seven lectures on Meat and Food Inspection, including taking of samples of Water, Food, and drugs for Analysis. Practical Demonstrations of Meat Inspection are given. The Lectures will include the subjects scheduled for the examinations of the Institute and the Sanitary Inspectors' Examination Board (formed by the Sanitary Institute and other bodies). The fee for Part 1 is 2*l.* 12s. 6d.; for Part 2 1*l.* 1s. 0d. or the complete course, 3*l.* 3s. 0d.

FIRE TESTS.—The British Fire Prevention Committee's operations for the summer season were completed last week with two tests at the Testing Station in Bayswater, when some armoured wood doors and an armoured concrete floor were under examination. Regarding the armoured door test, this was with tinned steel-clad armoured doors constructed in Manchester, one being a sliding door and one a hinged door, and they were tested for a duration of 1½ hours under a severe fire of gradually-increasing temperature, the highest temperature being over 1,800 deg. Fahr. The sliding door offered substantial resistance against fire. The floor test was with a composite floor of fine concrete strengthened by steel bands, and constructed by a Swiss firm. The floor was subjected to a test of 1¾ hours under a severe fire at a gradually increasing temperature to 1,800 deg. Fahrenheit, when the floor collapsed. Of other tests now in the report stage is a test with another pair of similar armoured doors. Further, with a floor of Australian Karri wood and with a thin partition by a Dutch firm. All the reports will be issued in due course. In framing the reports an innovation will, no doubt, be found, inasmuch as the metric system will henceforward be applied in the committee's reports as well as our own system of weights and measures, this being in accordance with a resolution arrived at at the International Fire Prevention Congress, requesting all reports of different countries to adopt the metric system as well as their local system of measurement and weight.

STEEL CHIMNEY STACKS.—In a recent number of the *Engineering Record* some simple rules are given for calculating the rivet spacing in the horizontal joints of self-supporting steel stacks and for determining the strains upon the anchor rods of these and similar structures. For the calculation of rivet spacing the stress per circumferential inch of section may be found by the equation $S=\frac{6P}{A}L^2$. Here P= pressure per vertical foot of stack, $A=\pi\times\text{radius}^2$, and L=distance of the section from the top of the stack. If to S be added the proportionate dead load for the weight of the structure above the section considered, division of the value of one rivet by this sum will give the required spacing in inches. To ascertain the anchor strains, the imaginary strain K on one circumferential inch of the circle on which the anchor rods are fixed may be found thus:—$K=M\div A$, where M is the bending moment and A is the area of the circle above mentioned. The maximum value of K so obtained multiplied by the length of arc between the anchors will give approximately the wind reaction on one rod.

RUBBER FOR BUILDING PURPOSES.—Writing in a recent issue of the *Agricultural Bulletin of the Straits and Federated Malay States*, Mr. Ridley mentions that the Jelutong tree (*Dyera costulata*) is one of the biggest trees of the Malay Peninsula, attaining a height of over 200 ft. It belongs to the order Apocynaceæ, ane is allied to Alstonia. Its chief use appears to be for making a water-proofing mixture used in the walls, floors, and roofs of houses; and this use, which is of comparatively recent date, appears to be the cause of the very large demand for it of recent years. It is used also in making all sorts of cheap rubber goods, especially rubber shoes, when mixed with other materials.

NEW SPANISH CEMENT INDUSTRY.—In an official communication just received at the Foreign Office from Mr. J. F. Roberts, British Consul-General for the district of Barcelona, it is mentioned that during the past year a most important industry, new to that country, was started. The Compania General d'Asfaltos y Portland, has been formed, with an initial capital of 100,000*l.* fully paid up, the capital supplied being entirely Spanish. The object is the working of an extensive mineral zone comprising asphalte, cement, lignite coal, and petroleum. The machinery for making the cement was purchased in the United States at a cost of nearly 40,000*l.*; the pipe line that is expected to produce 1,000 horse-power to drive the machinery is also American, and will be about two miles in length; the force will be supplied by an important waterfall on the River Zlobregat, the water-power being carried to the property by steel tubes on hydraulic wheels of the Pelton type. It is estimated that at the commencement an output of 30,000 tons of Portland cement will be effected yearly, but the plant is constructed to produce 500 barrels of the highest grade cement per day. The property is situated at Poblade Lillet, in the extreme north of the Principality of Catalonia, at the foot of the Pyrenees, at thirty-five kilometres from the station of Ripoll, and a great deal of money has had to be spent in constructing temporary roads and bridges from the mines to the nearest railway station, and a high-power locomobile is being used to haul the machinery over these roads; later on it is hoped to establish the railway line right up to the mines. The whole plant—a three-kiln one—is being built by American engineers.

CEMENT NOTES.—The British Vice-Consul at Malmö reports the establishment of new cement works at Klagshamn, Sweden.——From Formosa we learn that cement has disappeared as a separate item from the returns of imports from foreign countries, and the cement which now appears in the table is all imported from Japan, and has risen in value from 5,512*l.* in 1901 to 19,233*l.* in 1902.——In Grenoble, France, there are four cement firms, employing 2,000 hands, and producing annually 180,000 tons, of a total value of 200,000*l.*, the price charged being from 12s. to 1*l.* 16s. per ton, according to quality. There seems no reason (in the opinion of Mr. Lewis, the British Vice-Consul) why the production should not develop considerably, owing to the facilities offered by the use of water power for working and other purposes.

ARBITRATION CASE.—For the purposes of the Thames Embankment Extension Scheme the London County Council acquired property in Millbank-street and Church-street, Westminster, belonging to the Fawcett's Settlement Trustees. Recently the latter brought a claim for compensation in respect of the property acquired, and the inquiry was heard at Westminster before Mr. J. H. Clutton, as sole arbitrator. Counsel for the trustees put the claim at 5,500*l.*, while expert witnesses for the Council put the value at 4,000*l.* to 4,200*l.* The arbitrator has issued his award, in which he gives the sum of 4 485*l.* to the claimants.

PUBLIC CLOCK, BOURTON-ON-THE-WATER, GLOUCESTERSHIRE.—A large clock has just been erected on the Public Hall here by Messrs. John Smith & Sons, Derby. It has been made to the designs of Lord Grimthorpe.

CHARTRES CATHEDRAL.—The Paris Correspondent of the *Daily News* writes:—The north steeple of the Cathedral at Chartres has latterly shown signs of decay, several crevices having appeared suddenly, and the sudden collapse of this unique piece of twelfth-century architecture was feared. The Government architects have taken in hand its restoration; a wooden scaffolding—boarded round—has been built round the tower, which now presents an unwonted appearance, somewhat like the Tower of Pisa. The erection of the scaffolding, which was very dangerous, on account of risk of giddiness, has been completed in three weeks without accident. It will not be removed for several months.

WHAT IS THE CHEAPEST PAINT?—In the issue of the *Decorator* (an illustrated monthly journal) for August 22 is an interesting article by Mr. J. Cruickshank Smith, B.Sc., F.C.S., on this subject, from which we take the following concluding paragraphs:—"The following table, which I have compiled from data which may be regarded as fairly reliable, indicates how an engineer can figure out for himself what is the comparative economic value on a twenty years' basis of various anti-corrosive paints that may be brought under his notice. The cost of labour of application is not included; obviously the charge on this account will increase rapidly the greater the number of renewals that may be necessary. *Covering Capacity.*—Calculated from the figures given by Mr. G. H. Hurst that 10 lbs. of the following paints cover on metal—White lead, 648 sq. ft.; zinc white, 1,134 sq. ft.; red lead, 477 sq. ft.; red oxide, 870 sq. ft. *Durability*—The relative figures are those currently accepted by British and American engineers. *Cost.*—This is estimated at what is probably a maximum figure for the very best materials in large quantities. The paints here mentioned are understood to be supplied ready for the brush, and to be made with special reference to the purpose for which they are to be used:—

—	White Lead.	Zinc White.	Red Lead.	Red Oxide.
Covering capacity in sq. yds. per cwt. ..	806	1,411	594	1,083
Price per cwt. in shillings	32s.	36s.	32s.	28s.
Cost (in shillings) per 100 sq. ft.	·44	·28	·60	·28
Times painted in 20 years.....	5	5	3	7
Cost in shillings per 100 sq. ft. for 20 years.....	2·20	1·40	1·80	1·96
Relative economic value on 20 years' basis, the highest value being represented by 100	64	100	77	71

Let us suppose that in the above table the figure under zinc white representing the number of renewals necessary in twenty years be written seven instead of five, then the cost per 100 sq. ft. for twenty years will be 1·96 in place of 1·40, and the economic value of zinc paint will be brought down under that of red lead, and equal to that of red oxide; yet between the prime cost of materials in the case of red oxide and zinc white there is on our assumed price a difference of 8s. per cwt. This shows the fallacy of laying undue stress on the cost of the paint. One other point suggests itself in connexion with the comparison of the economic value of paints, and that is, how is it possible in practice to wait for, say, twenty years before an estimate can be formed as to the comparative merits of different protective materials? Of course, an opinion has to be formed after a comparatively short interval, say three or six months, but the trained eye of a person who has intelligently studied the subject practically can in the great majority of cases detect signs of wear and tear long before the paint has actually perished. In such matters it is after all not the skilful engineer or the erudite chemist who makes a bee-line for truth, but the man with observant eye and logical mind."

THE DEMOLITION OF BUILDINGS WITHIN THE CITY.—The great nuisance arising from the demolition of buildings in the City without proper protection to the public has been the subject of an inquiry by the Streets Committee of the City Corporation, whose members have been assisted with suggestions by the Royal Institute of British Architects, the Surveyors' Institution, and the Institute of Builders. The result has been the formulation of new by-laws, under which it is insisted that in the future, before any demolition takes place, all windows and other openings in the external walls shall be close boarded. Canvas or boarded screens, mats, and other suitable appliances must be used whenever required, and so placed as to reduce the nuisance arising from the escape of dust. Rubbish, lime, or mortar must not be shot or allowed to fall from floor to floor into any basement within 20 ft. of the public way between 10 a.m. and 6 p.m., except on Saturdays, when it will be permitted after 3 p.m. Further, no materials arising from the demolition of buildings shall be basketed, wheeled, or loaded into carts, or carted away between 10 a.m. and 6 p.m., except on Saturdays, unless proper provision has been made for the protection of the public from dust. Any person who commits a breach of the new by-laws will be liable to a fine of 5*l.* for each breach.

HOUSES IN THE UNITED KINGDOM.—According to a return prepared by the Treasury at the instance of Mr. Gibson Bowles, M.P., for the information of Parliament, it appears that the profits arising from houses in the United Kingdom, as shown by the returns made under Schedule A of the Income Tax, amounted in 1861 to 61,924,178*l.*, in 1871 to 87,721,110*l.*, in 1881 to 120,877,195*l.*, in 1891 to 143,146,177*l.*, and in 1901 to 184,572,687*l.*

CAPITAL AND LABOUR.

SUNDERLAND JOINERS' DISPUTE.—A ballot was taken on the 14th inst. among the Sunderland joiners on the question as to whether they would, as suggested at the conference convened by the Mayor in the Town Hall last Friday, submit the dispute to a Board of Trade arbitration. The result of the

ballot is as follows :—For arbitration, 105 ; against, 203. The employers met in the afternoon and considered the position, having in view the result of the men's ballot, and re-affirmed their willingness to submit to arbitration.

EMPLOYMENT IN THE BUILDING TRADES.—According to the *Labour Gazette* for August, employment in the building trades continues moderate, and shows little change as compared with either a month or a year ago. The percentage of unemployed trade-union members among carpenters and joiners was 3·3 at the end of July, compared with 3·4 at the end of June, and 2·9 a year ago. The percentage for plumbers was 6·7 at the end of July, as compared with 7·6 in June, and 6·5 in July, 1902. Employment with bricklayers is reported as fair, and better than a month ago. It is about the same as a year ago. With masons it is fair, and about the same as a month ago, but rather worse than a year ago. Employment with carpenters and joiners is fair, and about the same as a month and a year ago. With painters employment is moderate, and not so good as a month or a year ago. Employment with plasterers is dull.

PATENTS OF THE WEEK:

APPLICATIONS PUBLISHED.*

16,502 of 1902.—W. PEPPER : *A Combination Knocker, Letter Plate, and Bell Pull.*

This consists of the combination of a letter plate for attachment to doors and having a slot for the insertion of letters, a knocker which serves also as a cover for the said slot, a bell-pull operating a near or distant bell, and a frame or frames for holding and exhibiting cards or plates bearing names or other information.

16,738 of 1902.—J. D. KELLY, D. P. FISHER, and N. V. G. WIX : *Method of and Means for Ventilating Halls, Theatres, and other Places of Public Resort.*

This relates to means of ventilation, consisting in introducing into buildings a large number of separate currents of compressed air that may be reduced or increased in temperature before being introduced according to the requirements of the case, or, if desired may be perfumed.

20,863 of 1902.—A. VAN HOOYDONK : *Means or Apparatus for Attaching Electric Sconces and the Like to Walls, Ceilings, and other Places.*

The method of attaching electric sconces and the like to walls and other places which consists in fixing a socket having suitable contact pieces into the wall or other places and forming the end of the sconce or the like (or a separate fitting to each which the sconce or the like is attached) in such a manner that it may be readily attached to the said socket and make electric contact with the contact pieces therein and be readily detached therefrom.

3,419 of 1903.—A. HART : *Ventilating Window.*

A window having removable horizontally hung upper and lower sashes and means for opening and closing them, side frames or wings being also provided, which can be entirely removed, folded back, or held at right angles to the window frame to prevent draughts.

12,374 of 1903.—J. A. G. POWER : *Water-closet Seat Protectors.*

A detachable cover for water-closet seats, consisting of an expansible frame and a fabric cover retained in position upon the frame and upon the seat by the frame.

12,642 of 1903.—F. C. WRIGHT : *Screens for Windows, Doors, and the Like.*

A screen comprising a top bar having the lower portion of one side bevelled to form an opening, side bars connected to said top bar, a cross supporting strip having the extremities thereof secured to the side bar adjacent to the bevelled portion of the top bar, screen material passing around the said supporting bar, sleeves interposed between the supporting strip and the lower portion of the top bar, and nails driven through the supporting strip and sleeves and into the top bar.

13,236 of 1903.—J. OATES : *Machine for Trimming or Cutting-off Edges of Wall Decorations.*

This machine is intended to trim off the selvedge or raw edge of decorative materials in the nature of wall-paper, and is especially adapted for operating on materials stronger or heavier than ordinary wall-paper, such as lincrusta, anaglypta, and the like relief decorations. It consists of a main driving shaft rotated by a hand wheel, feed rollers and vaulting discs, adjustable guides being also provided.

13,771 of 1903.—J. A. K. MCGREGOR and LOCKERBIE & WILKINSON, LTD. : *Door Furniture.*

Door furniture characterised by a knob loosely mounted upon a secured spindle, and having a slot with winged grooves butting against a nut having a similar slot and winged grooves, and which is adjustably screwed on to the spindle, in combination with a staple having wing flanges which respectively take into the said slot and grooves.

13,817 of 1903.—C. HERMANSEN : *Fire-Grates.*

In open fire-grates the arrangement of doors provided in such a manner that while retaining the appearance of open fire such grates may be used as ordinary stoves, in combination with a movable grate travelling in groves, said grate, when the stove is to be used as an open fire-grate, being adapted to be lowered down in front of the fixed grate, and when the fireplace is to be used as a closed stove, is raised above the fixed grate and held in position by means of pins adapted to engage with downwardly-inclined notches in the grooves.

13,828 of 1903.—R. BARTHOLOMÄUS : *Flushing Cisterns.*

A flushing cistern for water-closets and the like, in which pistons adapted to be operated by the pressure of water supplied from the main are arranged in a cylinder, and connected to two pistons of smaller cross section, which are arranged in cylinders connected to the tank, so that when operated the pistons force the water from the cylinders with a pressure inversely proportional to the difference of cross-section between the pistons, the said water being discharged to the water-closets through a multi-way distributing cock, whereupon the spigot of the said cock is rotated so that water from the main acts on the pistons and causes the pistons to be moved towards each other, so that the water between the said pistons is then discharged through the cock to the closet.

14,003 of 1903.—J. C. MCMAHON : *Window Frame and Sash.*

The combination of a window frame, sashes movable in the frame and provided with grooves in their edges, and metal strips provided with one or more pair of guide ribs, the portions of the strips intermediate of the members of each pair being swelled out.

14,018 of 1903.—W. W. BENSON : *Couplings for Pipes, Conduits, and the Like.*

A coupling having a collar for engaging the ends of conduits, conductors, or the like, a ring having an edge adapted to bite into said conductor and faces that are initially of conical form, and a flanged sleeve for engaging said ring, and forcing it against said collar and into said conductor.

16,665 of 1902.—G. E. NEWTON, J. W. SOAR, H. DICKENSON, and D. MITCHELL : *Composition for Use in the Manufacture of Imitation Marble, Stone, or the Like.*

In the manufacture of imitation marble, stone, or the like, a composition consisting of burnt fireclay or china clay, spar, quartz, gypsum, marble chippings, broken earthenware or porcelain, granite, or like material, or any of them ground into powder, magnesite or Venetian cement, chloride of magnesia, and water, and with or without colouring matter.

18,270 of 1902.—W. H. HAMMOND and R. G. FOTHERBY : *Manhole or Inspection Chamber Covers for Drains, Sewers, and the Like.*

The invention relates to manhole or inspection chamber covers for drains, sewers, and the like. The object of the invention is to make a manhole cover, or inspection cover, absolutely air, gas, and watertight. To obtain this object, an inclined plane is introduced beneath the ordinary water grooves and cover as now attached to manhole covers and the like, on the inside of the frame, on which rests a separate plate surrounded with a bead or packing of asbestos, lead, rubber, or other suitable material, the packing resting on the aforesaid inclined plane. By means of the weight of the aforesaid plate, an air, gas, or watertight joint is thus secured. If necessary, a screw or screws may be provided in the cover, to put extra pressure on the lower plate.

18,953 of 1902.—H. PASSOW : *Process for Producing Cement.*

The process of producing cement consisting in obtaining a mixture of the vitreous product and the pumiceous product of cooled slag, so that such products shall both be present in substantial and preferably about equal quantities.

20,661 of 1902.—M. KUKL : *Construction of Floors or Pavements, Walls and Ceilings.*

The method of making floors and the like, which consists in adding oil to a floor mass, such as a mortar, stone, or cement mixture, to form a plastic mass, producing a continuous surface on a suitable ground, smoothing the mass thus spread, and letting it dry.

4,441 of 1903.—P. STEVENS : *Manufacture of Parquet Floors.*

The manufacture and laying down of inlaid floors or parquet floors upon panels or dead floorings of tar and metal or wood laths, by means of an adhesive substance having a basis of tar.

19,474 of 1902.—R. STANLEY : *Manufacture of Earthenware Sanitary Pipes, Cable Conduits, Ridge Tiles, and other like Objects.*

This invention relates to the manufacture of pipes or conduits and also ridge tiles, roofing tiles, and other like objects from semi-dry clay-dust or other material whereby they are subjected to end pressure. The moulded articles are delivered downwardly, and the actual pressure is needed only at one end of the mould, the opposite end pressure being obtained by moving the mould and top plunger simultaneously towards the stationary plunger. The pressed articles by this plan are delivered down from one side (*e.g.*, the shell) of the mould together with the other side (*e.g.*, the core), and the latter then drawn out of or away from the article, which is left standing on the top of the bottom plunger.

* All these applications are in the stage on which opposition to the grant of Patents upon them can be made.

MEETINGS.

SATURDAY, AUGUST 22.

Northern Architectural Association. — Excursion meeting, Blagdon and Stannington. Members to assemble at the lodge gates of the principal entrance to Blagdon Hall at 3.30 p.m.

SATURDAY, AUGUST 29.

Incorporated British Institute of Certified Carpenters. Visit to the Vauxhall Bridge Works. 3 p.m.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

August 5.—By SURRIDGE & SON (at Braintree).

Bocking, Essex.—The Garrett Farm, 182 a. 3 r. 3 p., f.	£3,050
Shop, tenement, and 1 a. 0 r. 9 p., f.	450
Eleven freehold cottage tenements	1,175
Sunnyfields and 15½ a., f.	1,650
Sloughhouse Farm, 45 a. 3 r. 33 p., f.	600
Gosfield, Essex.—Pear Tree Farm, 89 a. 1 r. 39 p., f.	2,000

August 6.—By WYATT & SON (at Chichester).

Oving, Sussex.—High Kettle Farm, 15 a. 0 r. 37 p., f.	825
The Withies Farm, 40 a. 2 r. 37 p., f.	1,050
Three freehold fields, 30 a. 1 r. 30 p.	1,220
Chichester.—80, East-st. and 20, North Pallant, s., f., y.r. 110*l.*	4,050
14, North-st., s., f., y.r. 30*l.*	650
Chapel-st., the freehold store, y.r. 8*l.*	220

By BEADEL, WOOD, & Co. (at Great Holland).

Great Holland, Essex.—Barnard's or Beckwith's Farm, 40 a. 2 r. 10 p., f., y.r. 45*l.*	1,170

By WHITFIELD & SONS (at Knockin).

Knockin, Salop.—The Heath Farm, 132 a. 3 r. 26 p., f.	2,550

By WILLIAM WESTON (at Uxbridge).

Yiewsley, Middsx.—Horton-rd., freehold building land (late Great Western Cement Works), area 3 a. 29 p.	970

August 7.—By THORNBORROW & Co. (at Penrith).

Penrith, Cumberland.—Crown-sq., f. veterinary's premises	1,500
Wordsworth-st., plot of land, area 1,078 yds., f.	189

August 8.—By FAREBROTHER, ELLIS, & Co. (at York).

Bramham, Yorks.—Tenter Hill, two cottages and 2 a. 2 r. 1 p., f.	300
Three enclosures, 14 a. 1 r. 15 p., f.	1,070
Myrtle Cottage, f., y.r. 5*l.* 5s.	180
Manor Farm, 70 a. 3 r. 20 p., f.	2,250
Little Habton, Yorks.—Newnsham or Can-ings, 6 a. 3 r. 28 p., f., y.r. 15*l.*	370
Habton Grange Farm, 88. 2 r. 9 p., f., y.r. 115*l.*	3,000
Habton House Farm, 168 a. 2 r. 19 p., f., y.r. 150*l.*	4,200
Butterwick, Yorks.—Bridge House Farm, 4¼ a. 0 r. 1 p., f., y.r. 47*l.*	1,300
Butterwick Farm, 392 a. 3 r. 25 p., f., y.r. 448*l.*	10,000
South Holme Farm, 72 a. 3 r. 19 p., f., y.r. 80*l.*	2,025
Cass's Farm, 75 a. 1r. 32 p. f., y.r. 70*l.*	1,900
Four enclosures, 27 a. 0 r. 23 p., f., y.r. 25*l.*	600
Muscoates, Yorks.—Sunley Court Farm, 137 a. 3 r. 23 p., f., y.r. 145*l.*	4,000
Trowbridge Farm, 168 a. 1 r. 22 p., f., y.r. 127*l.* 9s.	4,000
Enclosure of meadow land, 10 a. 0 r. 30 p., f., y.r. 7*l.*	200
Rye Dale, right of hay crop on 15 acres of meadow land	185

By WILLSON & PHILLIPS (at Southend-on-Sea).

Rayleigh, Essex.—Holly Trees Farm, 47 a., f., y.r. 150*l.*	2,650
Bull-la., freehold pasture land, 3¾ a., y.r. 20*l.*	375
High-st., Globe and Rose Villas, y.r. 46*l.*	730
Down Hall-rd., the Pantile meadows, 9½ a., f.	560
Rochford, Essex.—High-st., freehold butcher's shop and outbuildings, y.r. 35*l.*	760
Southend, Essex.—27, Cliff Town-rd., s., f., y.r. 50*l.*	1,220
Cliff Town-rd., freehold s. (toilet saloon), y.r. 70*l.*	1,220

August 10.—By THORNBORROW & Co. (at Carlisle).

High Hesketh, Cumberland.—Copyhold farm, 57 a. 0 r. 26 p., p.	2,445
Low Hesketh, Cumberland.—Copyhold farm, 8 a. 0 r. 18 p.	480

By JOHN D. WOOD & Co. (at Cirencester).

South Cerney, Glos.—Barston House and 1 a. 2 r. 35 p., f., p.	1,050
Walnut Tree Farm, 71 a. 2 r. 26 p., f.	2,000

August 13.—By BEADEL, WOOD, & Co.

Thorpe-le-Soken, Essex.—Freehold and copyhold occupation, 5 a. 0 r. 27 p., y.r. 20*l.*	250

By NEWBON, EDWARDS, & SHEPHARD.

Cricklewood.—4A and 6, Melrose-av., u.t. 97 yrs., g.r. 17*l.*, e.r. 45*l.*, and y.r. 42*l.*	850
Hackney.—104, Amhurst-rd., u.t. 63 yrs., g.r. 7*l.*, e.r. 45*l.*	465
Holloway.—54, 56, and 58, Andover-rd., f., y.r. 100*l.* 2s.	1,040
26 to 52 (even), Andover-rd., u.t. 49 yrs., g.r. 70*l.*, y.r. 486*l.* 4s. (in lots)	3,075
Islington.—26, Finsbury-st., f., w.r. 78*l.*	700
Isleworth.—16, Loring-rd., f., e.r. 26*l.*	215
Leytonstone.—90, Wallwood-rd., f., y.r. 30*l.*	435

By STIMSON & SONS.

Birchington, Kent.—Shakespeare-rd., freehold building land, 1 a. 2 r. 32 p.	850
Brentford, Middlesex.—The Ham, three railway arches, u.t. 55 yrs., g.r. 1s., g.r. 25*l.*	150
Battersea.—32 and 34, Park-gr., u.t 61¼ yrs., g.r. 12*l.*, y.r. 48*l.*	390
Canning Town.—252, Barking-rd., f., y.r. 100*l.*	1,675
Tucker-st., f.g.r.'s, 80*l.* 10s., reversion in 62 yrs.	1,740

Forest Gate.—126, 157, and 159, Halley-rd., f., w.r. 70*l.* 4s. £760
Haverstock Hill.—8, Queen's-cres., u.t. 46½ yrs., g.r. 8*l.*, y.r. 40*l.* 350

Contractions used in these lists.—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; p. for possession; e.r. for estimated rental; w.r. for weekly rental; q.r. for quarterly rental; y.r. for yearly rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; la. for lane; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; av. for avenue; gdns. for gardens; yd. for yard; gr. for grove; b.h. for beer-house; p.h. for public-house; o. for offices; s. for shops.

PRICES CURRENT OF MATERIALS.

*** Our aim in this list is to give, as far as possible, the *average* prices of materials, not necessarily the lowest. Quality and quantity obviously affect prices—a fact which should be remembered by those who make use of this information.

BRICKS, &c.

	£ s. d.	
Hard Stocks	1 15 6	per 1,000 alongside, in river
Rough Stocks and Grizzles.....	1 12 6	,, ,, ,,
Facing Stocks....	2 12 0	,, ,, ,,
Shippers	2 5 0	,, ,, ,,
Flettons	1 8 6	,, at railway depôt
Red Wire Cuts ..	1 12 6	,, ,, ,,
Best Fareham Red	3 12 0	,, ,, ,,
Best Red Pressed Ruabon Facing	5 0 0	,, ,, ,,
Best Blue Pressed Staffordshire ..	4 5 0	,, ,, ,,
Do. Bullnose	4 11 0	,, ,, ,,
Best Stourbridge Fire Bricks	4 8 0	,, ,, ,,
GLAZED BRICKS.		
Best White and Ivory Glazed Stretchers.....	13 0 0	,, ,, ,,
Headers	12 0 0	,, ,, ,,
Quoins, Bullnose, and Flats.....	17 0 0	,, ,, ,,
Double Stretchers	19 0 0	,, ,, ,,
Double Headers..	16 0 0	,, ,, ,,
One Side and two Ends.....	19 0 0	,, ,, ,,
Two Sides and one End	20 0 0	,, ,, ,,
Splays, Chamfered, Squints.....	20 0 0	,, ,, ,,
Best Dipped Salt Glazed Stretchers and Headers	12 0 0	,, ,,
Quoins, Bullnose, and Flats.....	14 0 0	,, ,, ,,
Double Stretchers	15 0 0	,, ,, ,,
Double Headers..	14 0 0	,, ,, ,,
One Side and two Ends.....	15 0 0	,, ,, ,,
Two Sides and one End	15 0 0	,, ,, ,,
Splays Chamfered, Squints.....	14 0 0	,, ,, ,,
Second Quality White and Dipped Salt Glazed	2 0 0	,, less than best.

	s. d.	
Thames and Pit Sand	6 0	per yard, delivered.
Thames Ballast	6 0	,, ,,
Best Portland Cement	30 0	per ton, delivered.
Best Ground Blue Lias Lime..	20 6	,, ,,

NOTE.—The cement or lime is exclusive of the ordinary charge for sacks.

Grey Stone Lime ..... 11s cd. per yard, delivered.
Stourbridge Fire-clay in sacks 27s. 6d. per ton at rly. dpt.

STONE.

	s. d.	
BATH STONE—delivered on road waggons, Paddington depôt	1 6½	per ft. cube.
Do. do. delivered on road waggons, Nine Elms depôt	1 8¼	,, ,,
PORTLAND STONE (20 ft. average)—		
Brown Whitbed, delivered on road waggons, Paddington depot, Nine Elms depot, or Pimlico Wharf	2 1	,, ,,
White Basebed, delivered on road waggons, Paddington depot, Nine Elms depot, or Pimlico Wharf....	2 2½	,, ,,

	s. d.	
Ancaster in blocks	1 11	per ft. cube, deld rly. depôt.
Beer in blocks	1 6	,, ,,
Grinshill ,, ...	1 10	,, ,,
Darley Dale in blocks..	2 4	,, ,,
Red Corsehill ,,	2 5	,, ,,
Closeburn Red Freestone	2 0	,, ,,
Red Mansfield ,,	2 4	,, ,,

YORK STONE—*Robin Hood Quality.*

	s. d.	
Scappled random blocks	2 10	per ft. cube, deld. rly. depôt.
6 in. sawn two sides landings to sizes (under 40 ft. super.)	2 3	per foot super. ,,
6 in. Rubbed two sides Ditto, Ditto	2 6	,, ,,
3 in. Sawn two sides slabs (random sizes)..	0 11½	,, ,,
2 in. to 2½ in. Sawn one side slabs (random sizes)	0 7½	,, ,,
1¼ in. to 2 in. ditto, ditto	0 6	,, ,,
BEST HARD YORK—		
Scappled random blocks	3 0	per ft. cube ,,
6 in. sawn two sides, landings to sizes (under 40 ft. sup.)	2 8	per ft. super. ,,

PRICES CURRENT (*Continued*).

STONE.

BEST HARD YORK—	s. d.	
6 in. Rubbed two sides Ditto	—	per ft. super deld. rly. depot.
3 in. sawn two sides slabs (random sizes)	1 2	,, ,,
2 in. self-faced random flags.....	0 5	,, ,,
Hopton Wood (Hard Bed) in blocks	2 3	per ft. cube.
,, ,, ,, 6 in. sawn both sides landings	2 7	per ft. super. deld. rly. depôt
,, ,, ,, 3 in. do.	1 2½	,, ,,

SLATES.

in. in.	£ s. d.	
20×10 best blue Bangor..	13 2 6	per 1000 or 1200 at ry. dep.
20×12 ,, ,, ,, ..	13 17 6	,, ,,
20×10 best seconds ,,	12 15 0	,, ,,
20×12 ,, ,, ,,	13 10 0	,, ,,
16×8 best ,,	7 0 0	,, ,,
20×10 best blue Portmadoc ..	12 5 0	,, ,,
16×8 best blue Portmadoc	6 5 0	,, ,,
20×10 best Eureka unfading green....	15 2 6	,, ,,
20×12 ,, ,,	17 2 6	,, ,,
18×10 ,, ,,	12 10 0	,, ,,
16×8 ,, ,,	10 5 0	,, ,,
20×10 permanent green	11 0 0	,, ,,
18×10 ,, ,,	9 5 0	,, ,,
16×8 ,, ,,	6 10 0	,, ,,

TILES.

	s. d.	
Best plain red roofing tiles..	42 0	per 1,000, at rly. depôt.
Hip and valley tiles....	3 7	per doz. ,, ,,
Best Broseley tiles	50 0	per 1,000 ,, ,,
Do. Ornamental Tiles	52 6	,, ,, ,,
Hip and valley tiles....	4 0	per doz. ,, ,,
Best Ruabon Red, brown or brindled Do. (Edwards)	57 6	per 1,000 ,, ,,
Do. ornamental Do.	60 0	,, ,, ,,
Hip tiles	4 0	per doz. ,, ,,
Valley tiles.....	3 0	,, ,, ,,
Best Red or Mottled Staffordshire Do. (Peakes)	51 9	per 1,000 ,, ,,
Do. Ornamental Do.	54 6	,, ,, ,,
Hip tiles	4 1	per doz. ,, ,,
Valley tiles.....	3 8	,, ,, ,,
Best "Rosemary" brand plain tiles	48 0	per 1,000 ,, ,,
Do. Ornamental Do.	50 0	,, ,, ,,
Hip tiles	4 0	per doz. ,, ,,
Valley tiles	3 8	,, ,, ,,

WOOD.

	At per standard. £ s. d.	£ s. d.
Deals: best 3 in. by 11 in. and 4 in. by 9 in. and 11 in.....	15 10 0	16 10 0
Deals: best 3 by 9.....	14 10 0	15 10 0
Battens: best 2½ in. by 7 in. and 8 in., and 3 in. by 7 in. and 8 in.....	11 10 0	12 10 0
Battens: best 2½ by 6 and 3 by 6 ..	0 10 0	less than 7 in. and 8 in.
Deals: seconds	1 0 0	less than best
Battens: seconds	0 10 0	,, ,, ,,
2 in. by 4 in. and 2 in. by 6 in. ..	9 0 0	9 10 0
2 in. by 4½ in. and 2 in. by 5 in. ..	8 10 0	9 10 0
Foreign Sawn Boards—		
1 in. and 1¼ in. by 7 in.	0 10 0	more than battens.
¾ in.	1 0 0	,,
Fir timber: Best middling Danzig or Memel (average specification	At per load of 50 ft. 4 10 0	5 0 0
Seconds	4 5 0	4 10 0
Small timber (8 in. to 10 in.)	3 12 6	3 15 0
Small timber (6 in. to 8 in.).....	3 0 0	3 10 0
Swedish balks	2 15 0	3 0 0
Pitch-pine timber (30 ft. average)..	3 5 0	3 15 0

JOINERS' WOOD.

	At per standard.	
White Sea: First yellow deals, 3 in. by 11 in.....	23 0 0	24 0 0
3 in. by 9 in.	21 0 0	22 10 0
Battens, 2½ in. and 3 in. by 7 in.	17 0 0	18 10 0
Second yellow deals, 3 in. by 11 in.	18 10 0	20 0 0
,, ,, 3 in. by 9 in.	17 10 0	19 0 0
Battens, 2½ in. and 3 in. by 7 in.	13 10 0	14 10 0
Third yellow deals, 3 in. by 11 in. and 9 in.	15 10 0	16 10 0
Battens, 2½ in. and 3 in. by 7 in.	11 10 0	12 10 0
Petersburg: first yellow deals, 3 in. by 11 in.	21 0 0	22 10 0
Do. 3 in. by 9 in.....	18 0 0	19 10 0
Battens.....	13 10 0	15 0 0
Second yellow deals, 3 in. by 11 in.....	16 0 0	17 0 0
Do. 3 in. by 9 in.	14 10 0	16 0 0
Battens.....	11 0 0	12 10 0
Third yellow deals, 3 in. by 11 in.....	13 10 0	14 0 0
Do. 3 in. by 9 in.	13 0 0	14 0 0
Battens	10 0 0	11 0 0
White Sea and Petersburg:—		
First white deals, 3 in. by 11 in.	14 10 0	15 10 0
,, ,, 3 in. by 9 in.	13 10 0	14 10 0
Battens.....	11 0 0	12 0 0
Second white deals 3 in. by 11 in.	13 10 0	14 10 0
,, ,, ,, 3 in. by 9 in.	12 10 0	13 10 0
,, ,, ,, battens.....	9 10 0	10 10 0
Pitch-pine: deals	16 0 0	18 0 0
Under 2 in. thick extra	0 10 0	1 0 0
Yellow Pine—First, regular sizes ...	33 0 0	upwards.
Oddments	22 0 0	24 0 0
Seconds, regular sizes	24 10 0	26 10 0
Yellow Pine Oddments	20 0 0	22 0 0
Kauri Pine—Planks, per ft. cube..	0 3 6	0 4 6

PRICES CURRENT (*Continued*).

WOOD.

JOINERS' WOOD.	At per standard. £ s. d.	£ s. d.
Danzig and Stettin Oak Logs—		
Large, per ft. cube	0 2 6	0 3 6
Small ,, ,, ...	0 2 3	0 2 6
Wainscot Oak Logs, per ft. cube ..	0 5 0	0 5 6
Dry Wainscot Oak, per ft. sup. as inch	0 0 7	0 0 8
¾ in. do. do.	0 0 6½	- - -
Dry Mahogany—Honduras, Tabasco, per ft. sup. as inch	0 0 9	0 0 11
Selected, Figury, per ft. sup. as inch	0 1 6	0 2 0
Dry Walnut, American, per ft. sup. as inch	0 0 10	0 1 0
Teak, per load	17 0 0	21 0 0
American Whitewood Planks—		
Per ft. cube	0 4 0	- -

Prepared Flooring—	Per square.	
1 in. by 7 in. yellow, planed and shot.....	0 13 6	0 17 6
1 in. by 7 in. yellow, planed and matched.....	0 14 0	0 18 0
1¼ in. by 7 in. yellow, planed and matched.....	0 16 0	1 1 6
1 in. by 7 in. white, planed and shot.....	0 11 6	0 13 6
1 in. by 7 in. white, planed and matched.....	0 12 0	0 14 0
1¼ in. by 7 in. white, planed and matched.....	0 14 6	0 16 6
¾ in. by 7 inch yellow matched and beaded or V-jointed boards	0 11 0	0 13 6
1 in. by 7 in. do. do. do.	0 14 0	0 18 0
¾ in. by 7 in. white do. do.	0 10 0	0 11 6
1 in. by 7 in. do. do. do.	0 11 6	0 13 6

: 6-in. at 6d. to 9d. per square less than 7-in.

JOISTS, GIRDERS, &c.

	In London, or delivered Railway Vans, per ton. £ s. d.	£ s. d.
Rolled Steel Joists, ordinary sections	6 5 0	7 5 0
Compound Girders ,, ,,	8 2 6	9 5 0
Angles, Tees and Channels, ordinary sections	7 17 6	8 17 6
Flitch Plates	8 5 0	8 15 0
Cast Iron Columns and Stanchions, including ordinary patterns	7 2 6	8 5 6

METALS.

IRON—	Per ton, in London. £ s. d.	£ s. d.
Common Bars.....	7 10 0	8 0 0
Staffordshire Crown Bars, good merchant quality	8 0 0	8 10 0
Staffordshire "Marked Bars" ..	10 10 0	- - -
Mild Steel Bars	8 15 0	9 5 0
Hoop Iron, basis price.....	9 0 0	9 5 0
,, ,, galvanised.....	16 0 0	- -

(* And upwards, according to size and gauge.)

Sheet Iron, Black.—		
Ordinary sizes to 20 g.	9 15 0	- - -
,, ,, to 24 g.	10 15 0	- - -
,, ,, to 26 g.	12 5 0	- - -
Sheet Iron, Galvanised, flat, ordinary quality—		
Ordinary sizes, 6 ft. by 2 ft. to 3 ft. to 20 g.....	12 15 0	- - -
,, ,, 22 g. and 24 g.	13 5 0	- - -
,, ,, 26 g.....	14 5 0	- - -
Sheet Iron, Galvanised, flat, best quality:—		
Ordinary sizes to 20 g.....	16 0 0	- - -
,, ,, 22 g. and 24 g.	16 10 0	- - -
,, ,, 26 g.....	18 0 0	- - -
Galvanised Corrugated Sheets:—		
Ordinary sizes, 6 ft. to 8 ft. 20 g.	12 15 0	- - -
,, ,, 22 g. and 24 g.	13 5 0	- - -
,, ,, 26 g.....	14 0 0	- - -
Best Soft Steel Sheets, 6 ft. by 2 ft. to 3 ft. by 20 g. and thicker ..	11 15 0	- - -
,, ,, 22 g. and 24 g.	12 15 0	- - -
,, ,, 26 g.	14 0 0	- - -
Cut nails, 3 in. to 6 in.	9 5 0	9 15 0

(Under 3 in. usual trade extras.)

LEAD, &c.

	Per ton, in London. £ s. d.	£ s. d.
LEAD—Sheet, English, 3 lbs. & up.	13 15 0	- - -
Pipe in coils	14 5 0	- - -
Soil pipe	16 15 0	- - -
Compo Pipe	16 15 0	- - -
ZINC—Sheet—		
Vieille Montagne ..... ton	26 0 0	- - -
Silesian	25 15 0	- - -
COPPER—		
Strong Sheet ..... per lb.	0 0 10½	- - -
Thin ..... ,,	0 0 11½	- - -
Copper nails ..... ,,	0 0 11	- - -
BRASS—		
Strong Sheet..... per lb.	0 0 10	- - -
Thin ,, ... ,,	0 0 11	- - -
TIN—English Ingots ..... ,,	0 1 4	- - -
SOLDER—Plumbers' ..... ,,	0 0 6	- - -
Tinmen's ..... ,,	0 0 8	- - -
Blowpipe ..... ,,	0 0 9	- - -

ENGLISH SHEET GLASS IN CRATES.

15 oz. thirds	2½d.	per ft. delivered.
,, fourths.....	1⅞d.	,, ,,
21 oz. thirds	3¼d.	,, ,,
,, fourths.....	2⅝d.	,, ,,
26 oz. thirds	3⅞d.	,, ,,
,, fourths.....	3⅛d.	,, ,,
32 oz. thirds	4⅝d.	,, ,,
,, fourths.....	4⅛d.	,, ,,
Fluted sheet, 15 oz.	2⅝d.	,, ,,
,, 21 oz.	3⅛d.	,, ,,
⅛ Hartley's Rolled Plate	1⅜d.	,, ,,
⅛ ,, ,, ,, ...	2d.	,, ,,
¼ ,, ,, ,, ...	2¼d.	,, ,,

[*See also page 215.*

COMPETITIONS, CONTRACTS AND PUBLIC APPOINTMENTS.

(For some Contracts, &c., still open, but not included in this List, see previous issues.)

COMPETITIONS.

Nature of Work.	By whom Advertised.	Premiums.	Designs to be delivered
*Sewage Disposal of Saltwood	Elham R.D.C.	30 guineas	Oct. 7
*New Hospital	Brighton & Hove Hosp for Women	50*l.*, 30*l.*, and 20*l.*	Nov. 9

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Forms of Tender, &c., supplied by	Tenders to be delivered
Twenty-six Cottages, Bedlington, Northumberland	The Coal Company	—. Weeks, Esq., Bedlington	Aug. 25
Additions to North Public School	Peterhead Burgh School Board	A. Clyne, Architect, 123½, Union-street, Aberdeen	do.
Water Main (18¼ miles)	Cheltenham Corporation	J. S. Pickering, Water Engineer, Cheltenham	do.
Infirmary and Laundry	Nuneaton Guardians	H. Quick, Architect, 64, Hertford-street, Coventry	do.
Paving, &c., Frensham-road	Farnham U.D.C.	R. W. Cass, Surveyor, South-street, Farnham	do.
Sewerage Works, South Main-road	Alnwick U.D.C.	G. Wilson, Surveyor, Green Bat, Alnwick	do.
School, Fort William, N.B.	.....	L. & J. Falconer, Architects, Fort William	do.
Bridge Abutment, &c., Ilkley	Wharfedale Estate Co., Ltd.	J. B. Fraser, Architect, 8, Park-square, Leeds	Aug. 26
Additions to Club Premises, Cork	.....	W. H. Hill & Son, Architects, 28, South Mall, Cork	do.
Sewerage Works, Rigby-road	Blackpool Corporation	J. S. Brodie, Borough Engineer, Blackpool	do.
Sewerage Works	Dursley R.D.C.	J. G. Wenden, Council Offices, Dursley	do.
Sewerage Works, &c., Slate-lane	Audenshaw (Lancs) U.D.C.	J. P. Wilkinson, Engineer, 301, Cathedral-street, Manchester	do.
Water Supply Works, Blairbine, Lochgilphead	Argyll Lunacy Board	Warren & Stuart, Engineers, 94, Hope-street, Glasgow	do.
Inn, Blaenangwent, Abertillery, Mon	Messrs. Webb Bros. & Co.	R. L. Roberts, Architect, Abercarn	Aug. 27
House and Shop, Queen-street, Amble	.....	E. D. Richardson, 7, Gibson-street, Amble	do.
Warehouse, &c., King-street, Halifax	.....	Jackson & Fox, Architects, Halifax	do.
Additions to Workhouse, Gibbet-street	Halifax Guardians	W. C. Williams, Architect, 29, Southgate, Halifax	do.
School and House, Goldthorpe	Bolton-upon-Dearne School Board	R. Higginbottom, Architect, Thurnscoe, Rotherham	do.
House, High-street, Treorky, Wales	Mr. J. J. Thomas	W. D. Morgan, Architect, Victoria Chambers, Pentre, Glam.	Aug. 28
Road Works, Gotre Fawr-road	Swansea R.D.C.	G. P. Thomas, Surveyor, Forest Fach, Swansea	do.
Two Villas, Sedbergh, near Kendal	Mr. G. Sedgwick	S. Shaw, Architect, Highgate, Kendal	do.
Works at Chapel, Dowlais, Wales	The Trustees	A. O. Evans, Architect, Pontypridd	Aug. 29
Cycle Works, St. Lawrence Gate, Drogheda	Mr. P. J. Fulham	F. H. Tallan, Architect, 356, Kildare-street, Dublin	do.
Road Works, Angel-road	Harrow-on-the-Hill U.D.C.	J. P. Bennetts, Engineer, Council Offices, Harrow	do.
Hall, Castle-Acre, Swaffham, Norfolk	The Oddfellows	Jas. Spencer, Swaffham, Norfolk	do.
Well Sinking near Bedford	Kempston U.D.C.	Beesley & Co., Civil Engineer, Victoria-street, S.W.	do.
Cast Iron Pipes	Devonport Corporation	Stevenson & Burstal, Engineers, 38, Parliament-street, S.W.	do.
Hotel, Sennen Cove, Land's End, Cornwall	.....	H. White, Architect, Penzance	Aug. 31
Twenty-nine Houses, Rowles-square, Rhymney	The Victoria Building Club	J. L. Smith & Davies, Architects, Aberdare	do.
Rebuilding part of Church, Salcombe (Devon)	.....	The Vicar, the Vicarage, Salcombe	do.
Sewage Disposal Works	Aylesbury U.D.C.	G. Chatterton, Civil Engineer, 6, The Sanctuary, S.W.	do.
Schools, &c., Burton-in-Lonsdale	The Wesleyans Trustees	R. Richardson, Halfway House, Cantsfield, Kirkby Lonsdale	do.
Twelve Cottages, Dee Basin-road	Chester Corporation	J. H. Dickson, Town Hall, Chester	do.
Station Works, Essie Station	Caledonian Railway Co.	J. Blackburn, 302, Buchanan-street, Glasgow	do.
Council Offices	Whickham (Durham) U.D.C.	J. B. Renton, Surveyor, Whickham	do.
Pipe Laying, &c. (45 tons) Haslemere	Hambledon R.D.C.	R. B. Grantham & Son, 20, Northumberland-avenue, W.C.	do.
Water Supply Works, Ennis (Ireland)	Lunacy Committee	F. O. Connor, Civil Engineer, Asylum, Ennis	do.
Undergound Conveniences, North-street	Guildford Town Council	C. G. Mason, Civil Engineer, Tuns Gate, Guildford	do.
Hotel, Turnberry (N.B.)	Glasgow & S.W.R. Co.	J. Miller, Architect, 15, Blythewood-square, Glasgow	do.
*Painting and Repairs at Infirmary, Bow-road	City of London Union	Clerk to the Guardians, 61, Bartholomew-close, E.C.	do.
*Congregational Church, High-street, Dover	Church Building Committee	Cresswell & Newman, 54, Castle-street, Dover	do.
Private Street Works	Kettering U.D.C.	Council's Surveyor, Market-place, Kettering	do.
Concrete Paving, &c., Needham Market, Suffolk	Trustees of the late Mr. F. Wright	H. Miller, Civil Engineer, 16, Museum-street, Ipswich	Sep. 1
Paving Works, &c., Belford-terrace, North Shields	Tynemouth Corporation	J. F. Smillie, Borough Surveyor, Tynemouth	do.
Granite Macadam, Preston	Lancs County Council	W. H. Schofield, Civil Engineer, Council Offices, Preston	do.
Twelve Houses, Margery-street, Carlisle	Mr. W. Johnstone	Johnstone Bros., Architects, 39, Lowther-street, Carlisle	do.
Three Cottages, Sigford, near Ashburton	Mrs. Seaman	A. Warren, Architect, Buckfastleigh	do.
Granite Road Metal	Dunstable Town Council	G. Simcox, Borough Surveyor, Town Hall, Dunstable	do.
Car Sheds, Osmaston-road	Derby Corporation	J. Ward, Civil Engineer, Babington-lane, Derby	do.
Wall, &c.	Easington Guardians	Farthing & Dunn, Architects, Shakespeare Chambers, Newcastle	Sep. 2
Offices and Boundary Wall, Skircoat-road	Halifax Corporation	J. Lord, Civil Engineer, Town Hall, Halifax	do.
*Fire Resisting Works, &c., Fountain Hospital, Tooting	Metropolitan Asylums Board	T. W. Aldwinckle & Son, 20, Denman-street, London Bridge, S.E.	do.
*Alterations to Hot Water Supply Apparatus, N.E. Hosp.	do.	Office of the Board, Embankment, E.C.	Sep. 4
Additions to Town Hall	Batley Corporation	W. Hanstock & Son, Architects, Batley	do.
*New Coastguard Buildings, near Sandown (I. of W.)	The Admiralty	Director of Works Department, 21, Northumberland-avenue, W.C.	do.
*Sanitary Work, Relaying Floors, &c., Darenth Asylum	Metropolitan Asylums Board	Engineer to the Board, Office of the Board, Embankment, E.C.	Sep. 5
*Paving Half Moon-lane with Asphalt	Borough of Camberwell	Borough Engineer, Town Hall, Peckham-road, S.E.	Sep. 7
Road Works	Barking (Essex) U.D.C.	C. F. Dawson, Surveyor, Public Offices, Barking	Sep. 8
Additions to Workhouse	Cannock (Staffs) Guardians	Ashton Veall, Architect, 84, Darlington-street, Wolverhampton	do.
*Wooden Bandstd., &c., Brickfields Gardens, Limehouse	London County Council	Archs. Dprtmnt., Genrl. Constrctnl. Sectn., 15, Pall Mall East, S.W.	Sep. 11
*Sewage Collecting Tank, &c. (212, Fort Cumberland)	Borough of Portsmouth	Borough Engineer's Office, Town Hall, Portsmouth	Sep. 16
Engine and Boiler House, Monument-lane, Egbaston	Birmingham Corporation	Mansergh & Sons, Civil Engineers, 5, Victoria-street, S.W.	do.
House, Myrtle-grove Estate, Bingley (Yorks)	.....	E. H. Parkinson, Architect, Old Bank Chambers, Bradford	No date.
Whinstone Road Metal, &c., near Huddersfield	.....	A. Graham & Sons, Huddersfield	do.
Villa Residence, Newland, Hull	.....	J. M. Dossor, Architect, 2, Manor-street, Hull	do.
Works at the Black Lion Inn, Main-street, Keswick	.....	Jennings Bros., Ltd., Castle Brewery, Cockermouth	do.
Infirmary Buildings, Longfleet	Poole Guardians	H. F. J. Barnes, Architect, Poole, Dorset	do.
Shop, &c.	Macclesfield Provident Soc., Ltd.	Jabez Wright, Architect, Macclesfield	do.
Additions to School, Meanwood-road, Leeds	Education Committee	W. S. Braithwaite, Architect, Leeds	do.
Reseating Wesleyan Chapel, Church-lane, Pudsey	.....	Danby & Simpson, Architects, 10, Park-row, Leeds	do.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Application to be in
*Clerk of Works	Chelmsford Town Council	Not stated	Aug. 31
*Clerk of Works	Branksome U.D.C.	2*l.* 10*s.* per week	Sep. 1
*Four Clerks of Works	Hornsey District Council	3*l.* per week	Sep. 7
*Clerk of Works	Cumberlnd & Westmorlnd Jnt. Asy.	Not stated	&c.
*Draughtsman	H.M. Dockyard, Sheerness	Not stated	No date.

PRICES CURRENT (*Continued*).

OILS, &c.

		£ s. d.
Raw Linseed Oil in pipes or barrels	per gallon	0 1 10
,, ,, ,, in drums	,,	0 2 2
Boiled ,, ,, in pipes or barrels	,,	0 2 1
,, ,, ,, in drums	,,	0 2 5
Turpentine, in barrels	,,	0 3 3
,, in drums	,,	0 3 6
Genuine Ground English White Lead	per ton	19 10 0
Red Lead, Dry	,,	19 10 0
Best Linseed Oil Putty	per cwt.	0 8 0
Stockholm Tar	per barrel	1 12 0

VARNISHES, &c.

	Per gallon. £ s. d.
Fine Pale Oak Varnish	0 8 0
Pale Copal Oak	0 10 6
Superfine Pale Elastic Oak	0 12 6
Fine Extra Hard Church Oak	0 10 0
Superfine Hard-drying Oak, for Seats of Churches	0 14 0
Fine Elastic Carriage	0 12 6
Superfine Pale Elastic Carriage	0 16 0
Fine Pale Maple	0 16 0
Finest Pale Durable Copal	0 18 0
Extra Pale French Oil	1 1 0
Eggshell Flatting Varnish	0 18 0
White Copal Enamel	1 4 0
Extra Pale Paper	0 12 0
Best Japan Gold Size	0 10 6
Best Black Japan	0 16 0
Oak and Mahogany Stain	0 9 0
Brunswick Black	0 8 6
Berlin Black	0 16 0
Knotting	0 10 0
French and Brush Polish	0 10 0

TO CORRESPONDENTS.

J. S. M.—J. C. (Amounts should have been stated).

NOTE.—The responsibility of signed articles, letters, and papers read at meetings rests, of course, with the authors.

We cannot undertake to return rejected communications.

Letters or communications (beyond mere news items) which have been duplicated for other journals are NOT DESIRED.

All communications must be authenticated by the name and address of the sender, whether for publication or not. No notice can be taken of anonymous communications.

We are compelled to decline pointing out books and giving addresses.

Any commission to a contributor to write an article is given subject to the approval of the article, when written, by the Editor, who retains the right to reject it if unsatisfactory. The receipt by the author of a proof of an article in type does not necessarily imply its acceptance.

All communications regarding literary and artistic matters should be addressed to THE EDITOR; those relating to advertisements and other exclusively business matters should be addressed to THE PUBLISHER, and *not* to the Editor.

TERMS OF SUBSCRIPTION.

"THE BUILDER" (Published Weekly) is supplied DIRECT from the Office to residents in any part of the United Kingdom, at the rate of 19s. per annum (52 numbers) PREPAID. To all parts of Europe, America, Australia, New Zealand, India, China, Ceylon &c., 26s. per annum. Remittances (payable to J. MORGAN) should be addressed to the publisher of "THE BUILDER," Catherine-street, W.C.

SUBSCRIBERS in LONDON and the SUBURBS, by prepaying at the Publishing Office 19s. per annum (52 numbers) or 4s. 9d. per quarter (13 numbers) can ensure receiving "The Builder" by *Friday Morning's Post.*

PUBLISHER'S NOTICES.

THE INDEX (with TITLE-PAGE) for VOLUME LXXXIV. (January to June, 1903) was given as a supplement with the number for July 11.

CLOTH CASES for Binding the Numbers are now ready, price 2s. 6d. each; also

READING CASES (Cloth), with Strings, price 9d. each.

THE EIGHTY-FOURTH VOLUME of "The Builder" (bound), price Twelve Shillings and Sixpence.

SUBSCRIBERS' VOLUMES, on being sent to the Office, will be bound at a cost of 3s. 6d. each.

CHARGES FOR ADVERTISEMENTS.

COMPETITIONS, CONTRACTS, ALL NOTICES ISSUED BY CORPORATE BODIES, COUNTY AND OTHER COUNCILS, PROSPECTUSES OF PUBLIC COMPANIES, SALES BY TENDER, LEGAL ANNOUNCEMENTS, &c. &c.

Six lines, or under ..... 6s. 0d.
Each additional line ..... 1s. 0d.

SITUATIONS VACANT, PARTNERSHIPS, APPRENTICESHIPS, TRADE AND GENERAL ADVERTISEMENTS.

Six lines (about fifty words) or under ..... 4s. 6d.
Each additional line (about ten words) ..... 0s. 6d.

Terms for series of Trade advertisements, and for front page, and other special positions, on application to the Publisher.

SITUATIONS WANTED (Single-handed—Labour only).

FOUR lines (about thirty words) or under ..... 2s. 6d.
Each additional line (about ten words) ..... 0s. 6d.

PREPAYMENT IS ABSOLUTELY NECESSARY.

***Stamps *must not* be sent, but all sums should be remitted by Postal Orders, payable to J. MORGAN, and addressed to the Publisher of "THE BUILDER," Catherine-street, W.C.

Advertisements for the current week's issue are received up to THREE o'clock p.m. on THURSDAY, but "Classification" is impossible in the case of any which may reach the Office after HALF-PAST ONE p.m. on that day. Those intended for the Outside Wrapper should be in by TWELVE noon on WEDNESDAY.

ALTERATIONS IN STANDING ADVERTISEMENTS or ORDERS TO DISCONTINUE same must reach the Office before TEN o'clock on WEDNESDAY MORNING.

The Publisher cannot be responsible for DRAWINGS, TESTIMONIALS, &c. left at the Office in reply to advertisements, and strongly recommends that of the latter COPIES ONLY should be sent.

PERSONS Advertising in "The Builder" may have *Replies addressed to the Office*, Catherine-street, Covent Garden, W.C. *free of charge.* Letters will be forwarded if addressed envelopes are sent, together with sufficient stamps to cover the postage. Unused stamps are returned to advertisers the week after publication.

AN EDITION Printed on THIN PAPER, for FOREIGN and COLONIAL CIRCULATION, is issued every week.

READING CASES, { NINEPENCE EACH. By Post (carefully packed) 1s.

TENDERS.

Communications for insertion under this heading should be addressed to "The Editor," and must reach us *not later than 10 a.m. on Thursdays.* N.B.—We cannot publish Tenders unless authenticated either by the architect or the building-owner; and we cannot publish announcements of Tenders accepted unless the amount of the Tender is given, nor any list in which the lowest Tender is under 100*l.*, unless in some exceptional cases and for special reasons.]

* Denotes *accepted.* † Denotes *provisionally accepted.*

ABERDEEN.—For the construction of main sewerage works, for the Town Council. Mr. W. Dyack, C.E., 41t, Union-street, Aberdeen :—

P. Tawse, contractor, Torry, Aberdeen* £5,542 10 1

AMERSHAM.—For the erection of cottages, for Mr. G. Joiner. Mr. John Parrish, architect and surveyor, Richmond-villas, Hoe-street, Walthamstow :—

G. Darlington, Amersham £900

CARDIFF.—For the erection of a Wesleyan church, Birchgrove, Whitchurch. Mr. Edwin Seward, architect, Cardiff :—

G. Hallett	£1,130 0 0
G. Griffiths	1,125 0 0
Ransome	1,099 4 8
Beams & Nephew	1,095 0 0
Lattey & Co.	1,092 0 0
Knox & Wells	1,017 0 0
S. Gunter	980 0 0
C. H. Hockridge	962 13 4
S. Hanson, Llanishen, near Cardiff*	950 10 0
Evans Bros.	950 0 0

CHATHAM.—For the supply of flints, &c., for the Corporation. Mr. Charles Day, Borough Surveyor, Town Hall, Chatham :—

Supply of Kentish Rag Headers.—150 tons at Corporation Depot.

Constable & Co., Ltd., 19s. 6d. per ton.
Bensted & Son, Maidstone,* 17s. 4d. per ton.

Flints.—165 cubic yds. at Rochester-street, Chatham.

R. D. Batchelor, 3s. 9d. per cubic yard, wash-mill flints.
T. Smitherman, Chatham,* 4s. 11d. per cubic yard, surface-picked flints.

430 cubic yds. at Victoria-road, Chatham.

R. D. Batchelor, 3s. 6d. per cubic yard, wash-mill flints.
T. Smitherman, Chatham,* 4s. 9d. per cubic yard, surface-picked flints.

CHERITON (Kent).—For asphalting, &c., Stanley-road, for the Urban District Council. Mr. Chas. Vawser, Surveyor, Public Offices, Cheriton. Quantities by Surveyor :—

Binsted & Son, Maidstone £173 2

DALTON-IN-FURNESS.—For the completion of the Carnegie Free Library, for the Urban District Council. Mr. W. Richardson, Surveyor, Council Offices, Dalton-in-Furness :—

Tyson & Sons	£3 486 18	Ashburner, Ltd.,	
Clark & Robinson	3,150 0	Dalton-in-Furness*	£2 903 0
		Thoms & Sons	2,752 18

DONCASTER.—For the execution of sewerage works, Balby, for the Balby-with-Hexthorpe Urban District Council. Mr. Geo. Gledhill, surveyor, 1, High-road, Balby, Doncaster :—

G. Ellis	£197 17
Geo. Gledhill	170 0
F. & E. Fox, Balby*	160 17

GATESHEAD.—For rebuilding the Causey House, Sheriff Hill, for Messrs. H. Emmerson & Sons. Mr. L. H. Armour, architect, 16, West-street, Gateshead :—

Veitch & Sons	£1,561 19 5	Ross & Son	£1,434 12 2
W. C. Tyrie	1,557 15 3	John Milne	1,429 9 6
T. & J. White	1,551 0 0	H. & B. Arkless	1,417 0 0
Hymers & Co.	1,550 0 0	George Bain,	
D. D. Hall	1,498 7 0	Dunstan*	1,367 11 0
John Craven	1,457 13 9		
Ravin & Hitcham	1,452 13 0		

GORDON (N.B.).—For the erection of schoolmaster's house, Gordon, Berwickshire. Mr. T. R. Atkinson, architect, Earlston, N.B. :—

Contract No. 1.—Excavating, Masonry, and Walling.

Bruce & Sons	£505 0 0	Rodger & Sons	£427 16 3
Wood	458 0 0	A. Smeaton,	
Mabin & Son	447 5 3	Greenlaw*	339 11 0
W. Linton	437 10 0		

Contract No. 2.—Carpentry and Joinery.

C. Brodie	£425	Riddle & Sons	£263
Brown & Son	375	J. Watson	262
W. Kerr	295	J. Hunter, Gordon*	252
Carfrae	269		

Contract No. 3.—Slating.

McLaren & Sons	£48 17 0	R. Murdison	£37 0 0
A. Hilson	44 10 0	T. B. Murdison, Earlston*	29 10 0
E. Speirs	39 2 0		

Contract No. 4.—Plumbing.

J. Jardine	£76 4 5	B. Ruthven	£67 0 0
R. Murdison	69 0 0	T. B. Murdison	65 0 0

Contract No. 5.—Plastering.

A. Clapperton	£54 10	A. Hilson, Allanton*	£48 15
E. Speirs	53 12		

Contract No. 6.—Painting and Glazing.

S. Fisher	£32 15 6	J. Broomfield,	
Wilson	25 11 0	Greenlaw*	£20 6 10

GRIMSBY.—For the widening of Brighowgate, the extension of Haven Bridge, and widening Old Dock-road, for the Town Council. Mr. H. Gilbert Whyatt, Engineer, Town Hall, Grimsby. Quantities by Engineer :—

Brighowgate.

Gilbert & Kirton	£992 0 0	G. W. Brown	£918 5 3
J. R. Waterman	958 16 3	H. Good	901 2 11
Hewins & Goodhand	927 0 0	W. Burkitt, Hull*	863 6 7

Haven Bridge and Old Dock road.

H. Good	£1,673 4	Hewins & Goodhand, Grimsby*	£1,180 10
Gilbert & Kirton	1,257 10		
J. R. Waterman	1,217 0		

HITCHIN.—For the supply and delivery of broken granite (1,800 tons) and broken ironstone slag for the Urban District Council. Mr. A. T. Blood, Surveyor, Council Offices, Hitchin :—

The Enderby & Stoney Stanton Granite Co., Leicester	2 in. broken granite 10s. 5d. per ton. 1½ in. broken granite 10s. 11d. per ton.
Phipps' Exors. Hunsbury Hill Ironworks, Northampton	6s. 5d. slag per ton.

HULL.—For the erection of a park-keeper's lodge, East Park, for the Corporation. Mr. J. H. Hirst, architect, Town Hall, Hull :—

T. Goates	£503 15 0	J. R. Woods	£477 11 4
Amalgamated Builders Ltd.	503 2 0	F. Arnott	454 9 0
G. F. Blackburn	498 8 0	Simpson & Son, Woodcock-st., Hull*	454 0 0
F. Singleton	492 0 0		
J. H. Fenwick	488 0 0		

KEIGHLEY.—For the erection of an engine-house and shed, Airside Mills, Cononley. Messrs. J. Haggas & Son, architects, North-street, Keighley :—

Masonry.—W. Smith .....
Joinery.—J. Greenwood .....
Slating.—W. Thornton £399 13 6
Plastering.—F. Davy .....
Plumbing.—A. Bage .....

[All of Keighley.]

LONDON.—For the erection of workshop, Columbia-road, Bethnal Green, for Mr. Hottenbach. Mr. John Parrish, architect and surveyor, Richmond-villas, Hoe-street, Walthamstow :—

A. Edwards, Cambridge-road £290

MAESYCWMMER (Wales).—For improvements to two chapels, for the Trustees. Mr. E. Jones, architect and surveyor, Porth. Quantities by architect :—

Paul & Sons, Thompson-street, Barry Dock, Glam., S.W.* £303 8 4

MALMESBURY (Wilts).—For additions to water-supply works, for the Corporation. Mr. J. W. Restler, Engineer, Southwark and Vauxhall Water Co., Southwark Bridge-road :—

Hayward & Tyler‡	£972 0	Carson & Toone	£623 0
Grover & Co.	900 0	Mather & Son, Wellingborough*	529 0
Tilke & Smith	709 10		
Excelsior Engineering Co.	668 0		

‡ Exclusive of labour for enlarging tank.

MERTHYR TYDFIL.—For rebuilding 105 and 106, High-street, Merthyr. Mr. C. M. Davies, architect, 112, High-street, Merthyr :—

John Williams	£2,997 8	Evan Jones, 1, Aeron-terrace, Dowlais*	£2,650 0
John Jenkins	2,952 0		
Lloyd & Tape	2,880 0		
Lewis Davies	2,850 0		

PERSHORE.—For the construction of storm-water drain, &c., for the Worcestershire County Council. Mr. J. H. Garrett, County Road Surveyor, Shire Hall, Worcester :—

Nicholas Bros.	£249 8 0	W. Nicholas	£198 15 0
Panter & Sons	210 15 2	J. Coombe, Worcester-road, Pershore*	197 10 0
T. Walker	208 0 0		
J. W. Smith	204 11 6		

RAMSBOTTOM (Lancs).—For the execution of road works, Hardy and six other streets, for the Urban District Council. Mr. T. H. Bell, Surveyor, Council Offices, Ramsbottom. Quantities by Surveyor :—

Chadwick Bros, Blackburn* £219

[Labour only. Materials supplied by Council.]

RAMSGATE.—For the supply of granite kerbs and setts, for the Town Council. Mr. T. G. Taylor, Borough Engineer, Town Hall, Ramsgate :—

	Kerb. s. d.	Setts. £ s. d.
Mountsorrell Co.	1 8½	2 2 3
J. Freeman	1 2	1 10 0
A. & F. Manuelle	1 1½	1 7 5
Hughes & Co.	1 3	1 2 0
Blichfeldt & Co.	1 1½	1 9 0
W. Wilson	1 4	1 6 10
Brunton & Son	0 11½	1 4 0
Goodchild & Co.	1 3½	1 12 0
,, ,,	1 1½	1 7 9
Burgess & Co.	1 8	1 9 6
Watson & Co.	1 2	1 15 0
Goldie & Co	1 2	1 5 6
International Co.	1 8	1 11 9
J. Brunton	1 2½	1 11 0
Sommerfeld & Mead	1 2½	1 11 0
J. H. Scanlan	1 5	1 5 0
Gordon & Son	1 1	1 9 6
Brookes, Ltd.	1 1½	1 4 0
Road Maintenance Co.	1 1½	—
Trickett & Son	1 2	1 7 6
H. L. Cooper	1 2	1 9 6
Griffiths & Co.	1 2	1 9 6
Van Praagh & Co.*	1 0½	1 6 3

[*See also next page.*

ST. NEOTS.—For the supply of granite road metal, kerbing, &c., for the Urban District Council. Mr. John Edey, surveyor, South-street, St. Neots, Hunts :—

	s.	d.	
Ellis & Everard, Burdon Hill	11	6	Ton for 2½ in. broken granite.
Gumbey & Co., Sutton Bridge....	10	3	Ton for 2 in. Stoney Stanton ditto.
Groby Granite Co., Groby, near Leicester.....	10	6	Ton for 1½ in. Groby ditto.

Quantity—500 tons from each.

Van Praagh & Co., 6, East India Avenue	1	3	Foot lineal for 1,000 of 6 in. by 12 in. granite kerb.

[All the above delivered at St. Neots Station.]

SHREWSBURY.—For the erection of a covered cattle sale ring, for the Corporation. Mr. W. Chapple Eddowes, Borough Surveyor, The Square, Shrewsbury :—

E. H. Nicholas	£1,280	0	0
Geo. Bullock..	1,093	0	0
Hadley & Son.	1,086	11	8
A. G. Roberts.	1,053	19	0
Jno. Gethin ..	£1,037	0	0
Morris & Sons	1,020	0	0
H. Price, Shrewsbury*	996	0	0

[Borough Surveyor's estimate, £1,000]

SUNDERLAND.—For the erection of vicarage, St Mary's, Tyne Dock, for the Rev. L. P. Williams. Messrs. J. Potts & Son, architects, 57, John-street, Sunderland. Quantities by architects :—

R. Storey	£2,100	10	
J. Young.....	2,100	0	
Robertson	2,000	0	
W. B. Cooper....	1,997	10	
J. B. Stott	1,980	0	
W. Hall	£1,960	0	
J. Armitage	1,950	0	
W. D. Allison ..	1,909	8	
S. Sheriff, South Shields	1,869	11	

THORNTON HEATH.—For new drainage and sanitary works at Nos. 14 and 16, Quadrant-road, and Nos. 16 and 18, Elliott-road. Mr. E. H. Dance, architect and surveyor, 185, Victoria-street, S.W. :—

J. Westbrook.....	£152	5	
Kemp & Son.....	130	5	
H. Bacon*.....	£122	9	

TONBRIDGE (Kent).—For the supply of 1,200 tons granite road metal, for the Urban District Council. Mr. W. L. Bradley, C.E., Tonbridge Castle :—

		Per ton. s.	d.
C. M. Manuelle, London	2 in.	14	6
	1½ in.	14	9
	½ in.	13	0

WITHAM (Essex).—For the erection of an engine-house, &c., for the Urban District Council. Mr. F. S. Courtney, engineer, 25, Victoria-street, S.W. :—

Wm. Brown	£2,550		
Windsor & Co.....	2,306		
Smith & Son.....	2,025		
Richards & Son	2,007		
T. Hutchison	£1,958		
Ernest West, Chelmsford*.....	1,850		

WOODHALL SPA (Lincs.).—For the execution of sewerage works, for the Urban District Council. Mr. Ernest Bolton, Surveyor, Woodhall Spa, Lincs.:—

F. Steadman..	£3,555	5	0
E. T. Edwards	2,526	15	6
Vickers & Co.	2,350	0	0
The Oak Building Co.....	2028	18	11
F. M. Harrison, Lincoln*	£1,994	4	3
Roberts & Co.	1,483	0	0
Spokes & Sons	1,438	0	0

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F. Steadman	£3,555	5	0
E. J. Edwards	2,526	15	6
Vickers & Co.	2,350	0	0
Oak Building Co.	2,028	18	11
J. M. Harrison, Lincoln*....	£1,994	4	3
Roberts & Co.	1,483	4	0
Spraker & Sons	1,438	0	0

WORTHING.—For the erection of fire brigade station, cottages, &c., High-street, for the Corporation. Mr. Frank Roberts, Borough Surveyor, Municipal Offices, Worthing. Quantities by Borough Surveyor :—

F. Farnfield ..	£3,864	12	5
Bostel Bros. ..	2,925	0	0
Potter Bros. ..	2,791	0	0
Longley & Co.	2,739	0	0
Cook & Sons..	2,679	0	0
W. Sandell ..	2,617	10	0
W. W. Sandell	£2,603	2	0
Sattin & Evershed.....	2,548	0	0
Rowland Bros., East-street, Horsham* ..	2,309	0	0

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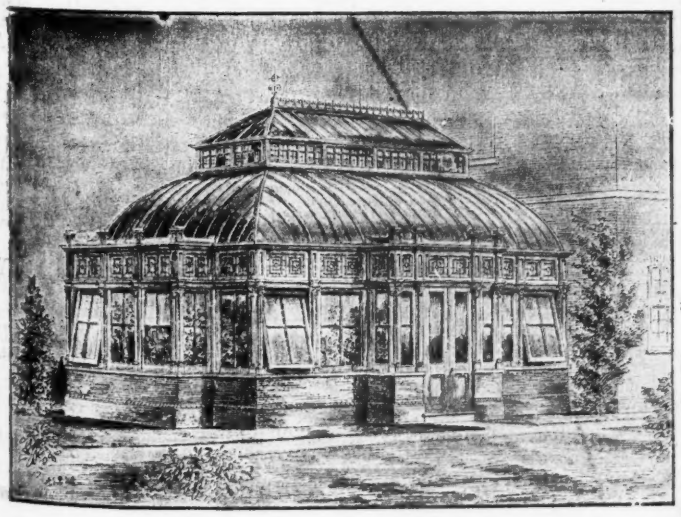

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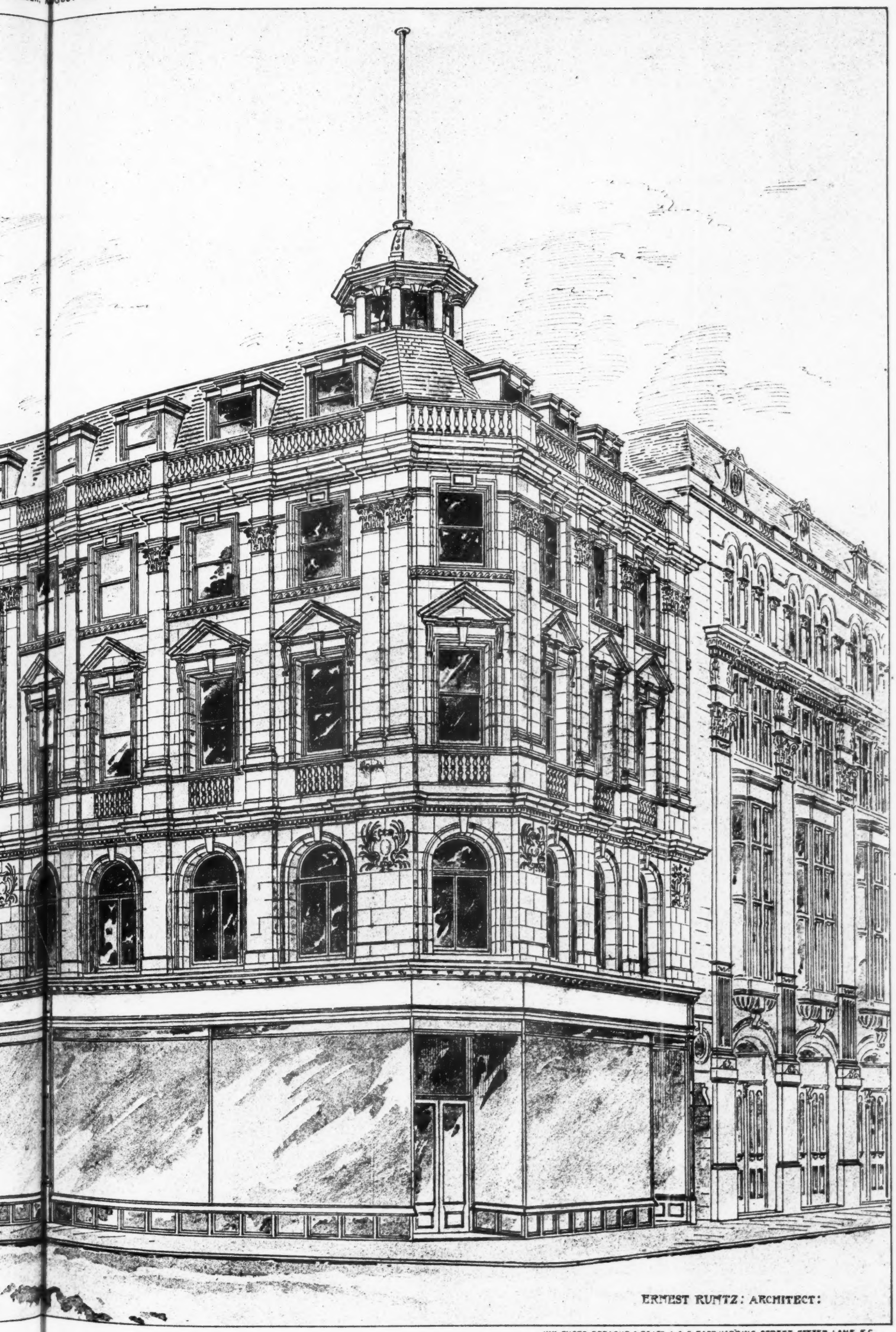

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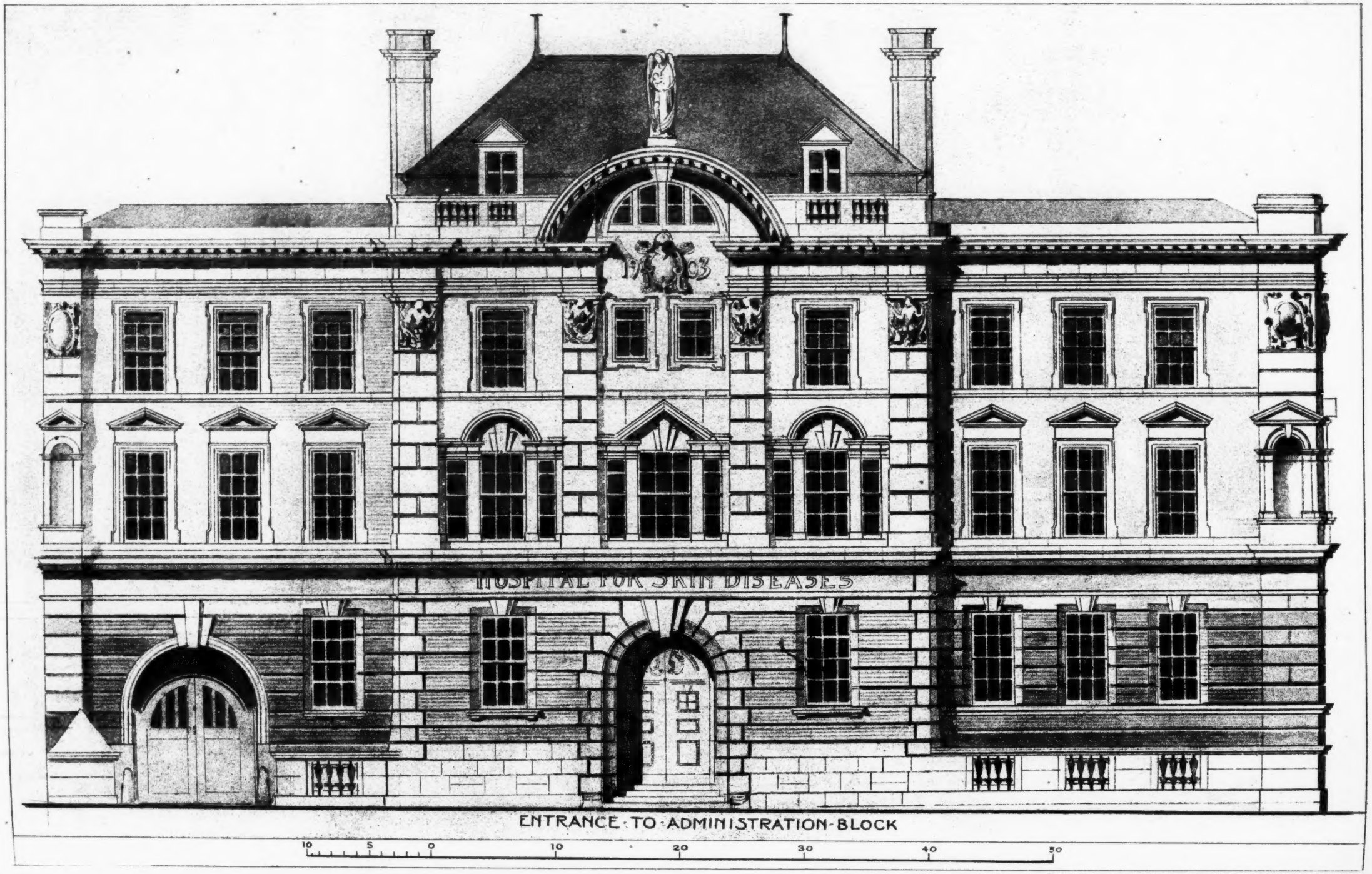

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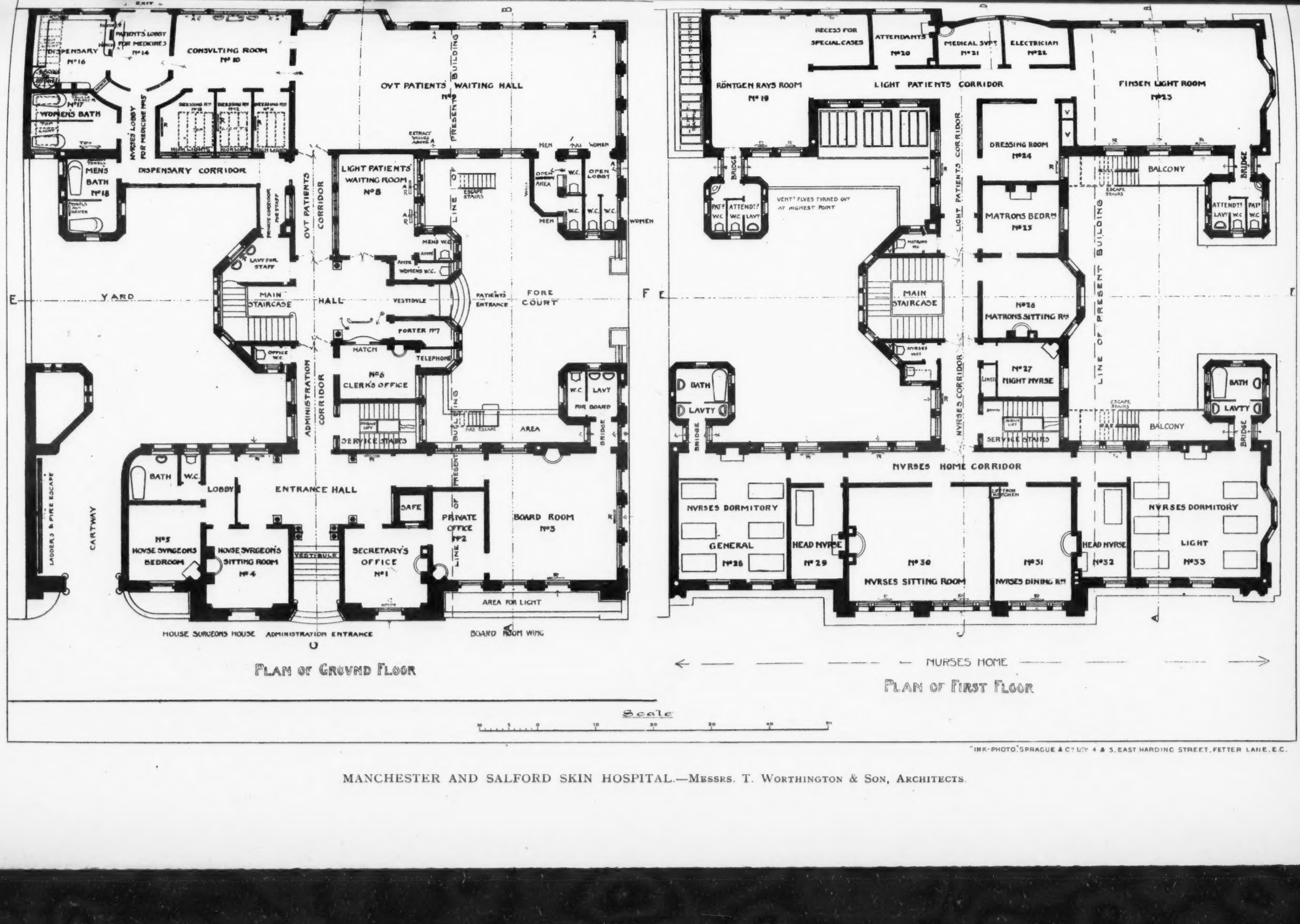

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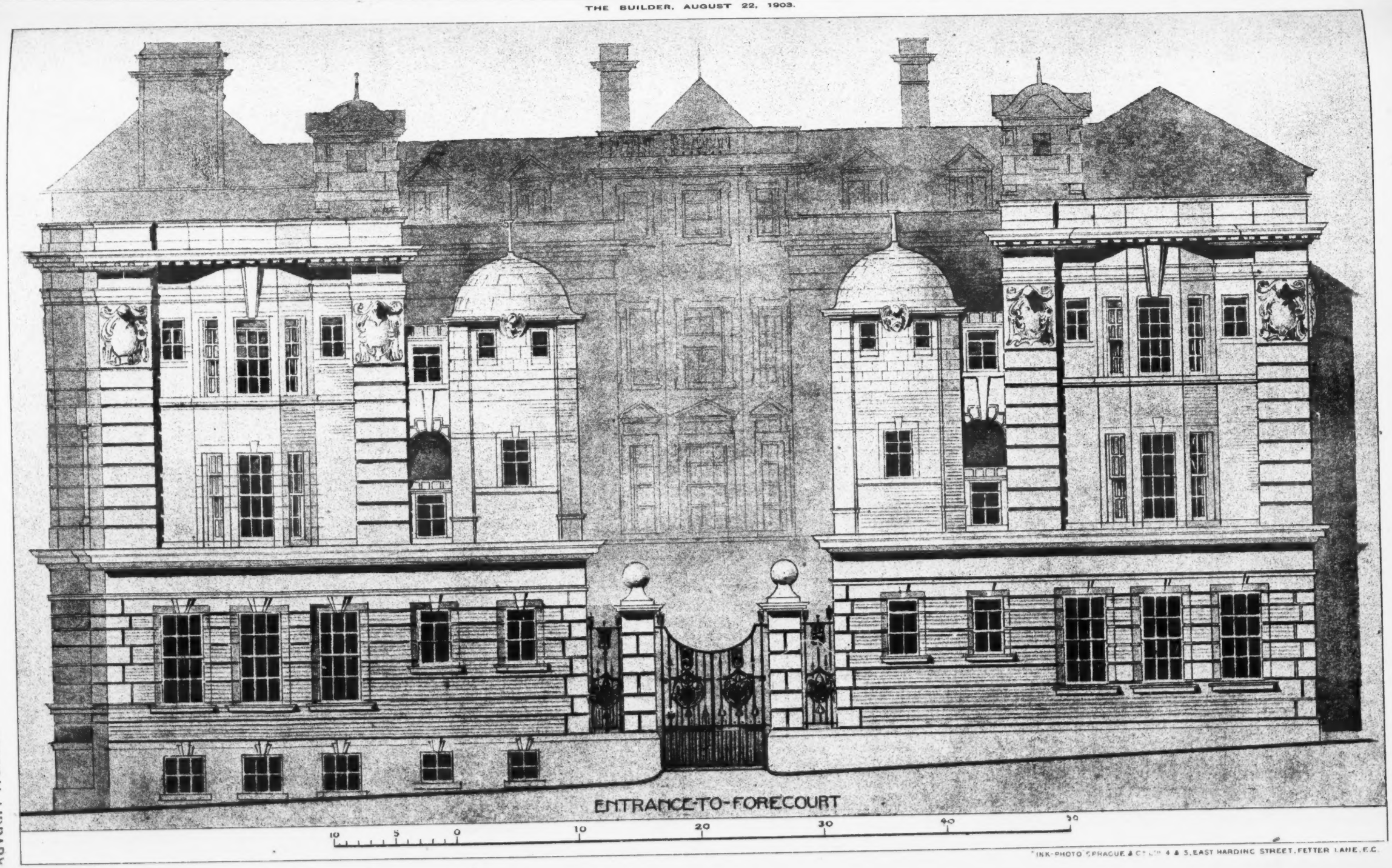

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